JUN 10 1939
Medical Library

VOL. XXXII. NO. 7 MAY, 1939

PROCEEDINGS *of the* ROYAL SOCIETY OF MEDICINE

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Section of Dermatology

President—H. HALDIN-DAVIS, F.R.C.S.

[*February* 16, 1939]

DEMONSTRATION

Emulsifying Bases with Particular Reference to their Advantages when Modified for Use as a Protective in Industry.

By P. B. MUMFORD, M.D.

THE following items were demonstrated at the beginning of the meeting :—

Section A.—Ointment Bases

Examples :—

(1) HEB SIMPLEX (Liquid Paraffin, Petroleum Jelly, Higher Fatty Alcohols and their phosphated esters—HOMOGENIZED—a simple ointment base, for all purposes, as a vehicle.

(2) HEB COMPOUND (as Simplex but Titanium Oxide and Perfume added). A cosmetic vehicle to which therapeutic agents are added—used for acne since addition of water with light massage gives emulsion, which on gently drying, leaves a cosmetic base for powdering without loss of therapeutic efficiency.

(3) Calamine, Lime Water and Olive Oil as normally dispensed.

(4) Calamine, Lime Water and Olive Oil with 12% HEB.

(5) Medium smeared with Ung. Hyd. Ammon. and cleaned with Boric Lotion.

(6) Medium smeared with Ung. Hyd. Ammon. in HEB and cleaned with Boric Lotion.

(7) Iodine added to Paraffin Molle base and merely suspended therein.

(8) Iodine added to HEB, and dissolved.

(9) Diazonium Test showing that active agents in the Petroleum Jelly cannot utilize body fluids, whereas the same agents in HEB *can* utilize serous discharge, and even insensible perspiration to bring about reaction. Such fact is therapeutically utilized in :—

(10) Active Chlorine from inorganic or organic Chlorine Compounds is easily and steadily released from HEB in the presence of serous discharge.

(11) Active Chlorine from inorganic or organic Chlorine Compounds is inefficiently released from a normal base in the presence of serous discharge.

(12) LAC. HEB.—a non-irritant cleansing solution, consisting of approximately 5% of HEB Simplex in water. Cleans in oil phase and water phase.

Section B.—Protective Bases in Use in Industry To-day

(13) VASELINE AND LANOLIN PROTECTIVE. A true barrier which must, however, be removed by strong detergents, particularly after entering hair follicles.

(14) COLLOID JELLY PROTECTIVES which dry rapidly and contract. Film protective of doubtful efficiency.

(15) UNSTABLE EMULSION PROTECTIVES. Breakdown on evaporation or on addition of weak acids and electrolytes. Note result of adding " artificial human sweat " (*a*) and (*b*).

(16) PROTECTIVES OF SOAP TYPE. These break down on contact with weak acid or salts, with separation of fatty acid or insoluble soap. They are highly alkaline (*a*) and (*b*) and may be irritant as such.

Protective Bases (HEB) as suggested

These substances may be utilized, either alone in either form, or may be employed after addition of specific " neutralizers ", applicable to any particular branch of industry. Their constitution is a variation in proportion of the HEB preparations with water added. The normal form does not contain any animal fat, and is of low surface tension, The waterproof form includes a proportion of lanolin.

(17) HEB PROTECTIVE NORMAL.

(18) HEB PROTECTIVE WATERPROOF.

(19) Paper and fabric handled after firm rubbing of hands with HEB Protective (Normal) remains unmarked.

Emulsifying bases possess special properties not shared by other ointment bases, such as their miscibility with fluid, their texture, neutrality, stability, and capacity to combine the physically incompatible. They combine with perspiration and serum but do not dehydrate, nor do they appear to exercise osmotic effect on serous exudate ; indeed they utilize both perspiration and serum therapeutically.

There is no chemical or physical reason, to my knowledge, why they should irritate in the absence of specific allergy. Their utility and possible disadvantages are matters for further consideration.

I have previously referred to the properties of these emulsifying bases in the *Journal of Dermatology* (1938, **50**, 540) and the *British Medical Journal* (1939 (ii), 266). Two points are worthy of stress. The simplest is the capacity of HEB to couple hitherto physically incompatible medicaments. A dermatologist earns the gratitude of the patient if he can provide a preparation which is cosmetically pleasant as well as therapeutically efficient. An acne "ointment" can be a perfect and efficient cosmetic powder base without losing activity; lime water and oil can be satisfactorily combined. Secondly, these substances utilize, rather than resent, perspiration and serous exudate. Pyoderma gangrænosa is one of the dermatologist's bugbears—I have recently cured such a case in six weeks which had some twenty lesions of many months' duration and where surgical and medical treatment had failed. Dichloramine T in HEB provided a continuous non-irritant release of nascent chlorine with the help of a local exudate which had hitherto provided a bar to progress. Iodine can be used, without its irritant spirit vehicle, in its true form. Every dermatologist can imagine simple clinical disturbances wherein a physical property of this type could be advantageously applied.

The HEB protectives are a logical by-product. Though investigations are incomplete, this demonstration has been given because, judged by chemical, physical, and physiological standards, they are theoretically efficient. Many variants from basic principle are required. For example these preparations are useless to protect against oil-soluble irritants, soap solutions, and highly concentrated dye solutions in spirit. With solids in powder form they are highly efficient and also in oil and water suspensions.

Each and every problem of industrial dermatitis must be faced individually, but with bases of this type a reliable foundation is provided on which a rational superstructure may be built. Fundamental principles of their chemistry and physics having been realized, most difficulties should be overcome. Theoretically vaseline, paraffin, and lanolin, cannot penetrate, they cannot reach fissures, hair follicles, sweat

ducts, or small cavities. Emulsifying bases can reach such areas and, having arrived, utilize the fluids therein for their own therapeutic end. The therapeutic uses of HEB protectives in xeroderma and irritative dermatitis of external origin, and in cosmetic problems are far wider and beyond the scope of these communications.

It is unnecessary, I am sure, to absolve myself of even indirect financial interest in these preparations, but I would like to say that the chemical formulæ and the solution of the very abstruse problems of emulsification are not to be credited to myself but to Mr. Holden and the staff of Messrs. Halden of Manchester. Three years ago, having seen certain commercial preparations depending for their efficiency on surface tension phenomena and manufactured by Messrs. Halden, I put forward certain criteria of what I considered to be an ideal "ointment", and invited their views. Many compounds were produced and finally in July 1938 the original HEB was put before the British Dermatological Association. As a matter of comment this preparaton has been radically improved within the last fortnight by the installation of new emulsifying apparatus. The protectives are the legitimate offspring of the original emulsifying base but must be regarded as yet in their infancy.

Discussion.—Dr. F. A. E. Silcock: I was first interested in emulsifiers through contact with textile firms who use emulsifying agents in connexion with removing grease stains from fabric in their work. In 1937 I spoke at the British Medical Association meeting in Belfast (Dermatological Section) about emulsified preparations. I had been quietly working on the subject in Leicester, but owing to routine work, I was obliged to let the matter lapse for a while.

This problem is a big one, quite apart from bringing our methods of making ointments and lotions more up to date.

The use of emulsifying bases as a protective in industry is very important. Dermatologists in large industrial areas meet with all kinds of most difficult problems. For instance, I have been asked to see a firm whose workers have suffered as a result of contact with sulphides and lime in solution. Then one also comes up against the problem of chrome, sometimes used in solutions and at others in vapour form; in fact, there are all kinds of weird problems which the average non-industrial dermatologist does not come into contact with.

In my work on emulsifying bases I first used triethanolamine, which is strongly alkaline, but to neutralize it I used stearic, oleic, palmitic, or butyric acid with it, all acids present in normal sweat. For the past two or three years a hand cream has been in use at the Leicester Royal Infirmary, and has been used also as a protection against lysol, biniodide of mercury, and various antiseptic lotions, &c., which may cause dermatitis. In this cream some magnesium stearate is incorporated, but one can use titanium stearate instead, both with the idea of providing a mechanical barrier as well as making a smoother and silkier compound. I think you will agree that it is quite an elegant product. This cream has just been tested as regards protection against colloidal carbon particles rubbed on the skin, in a similar manner to that demonstrated with HEB protective normal, and Mr. Holden found it to be quite effective in that respect.

A chemist told me recently that he doubted if a stable neutral soap or emulsion existed, so I took some of this particular cream, which had been in stock for about three months, and tested it with litmus paper, but the reaction appeared to be just the same as when freshly prepared, that is very slightly alkaline, whereas that of HEB protective cream was neutral. Alkalinity, so long as it is slight, does not seem to matter a great deal, because normal sweat is acid, but in certain conditions it may become alkaline.

In connexion with sweating, all kinds of problems arise in industry. The psychological element comes in, wet and dry bulb thermometer readings, as well as barometric pressure above or below ground. All these come into the picture, and it is hence most difficult to get something applicable, as a skin, protective to every factor that may arise.

Another point, which I do not think Dr. Mumford mentioned in connexion with the emulsifying base, is its use in greasy acne vulgaris cases, the patient's sebaceous secretion being used as an emulsifying agent; in other words, making a soap emulsion on the patient's own body, and so trying to get rid of a little of the excessive greasiness from the skin and sebaceous follicles. This is quite an interesting thing to do. In fact, many uses occur to which emulsifying agents and bases can be put in dermatological treatment.

Dr. A. C. ROXBURGH: I have been using HEB ever since last September and have found it extraordinarily useful in the treatment of impetigo. It is a good thing to put on the hands when chapped, and is an excellent ointment base for the scalp. It has not got the unpleasant smell of lard. I hope Dr. Mumford will persevere with his work and that he will be supported by others using the emulsifying bases.

Dr. SYBIL HORNER: I should like to express my appreciation of Dr. Mumford's paper. We in the Factory Department of the Home Office have been working with various substances over a number of years with a view to the prevention of dermatitis in industry. I am bound to confess that we have not yet found the perfect preventive. There are a number of trade preparations of which the formulæ are not known to the users, and most of which are open to the objection that they are soluble either in spirit, oil, or water. There is not in them the perfect barrier. And of course it must not be forgotten that even with an improved base, such as HEB, much depends on the individual factor. The worker still has to apply the ointment rather meticulously and to reapply it if there is any break in the surface of the skin.

I hope to distribute samples of HEB over the country and to get works medical officers to report on the results of their use, because it seems to me that this highly emulsified base will perhaps prove the solution of our present difficulty and thus fill the gap in cases in which other barrier substances have partially failed. Certainly the use of the barrier substance has helped to reduce the number of cases of industrial dermatitis reported to the Home Office. Almost daily I hear from firms who have tried various substances which, although they are not perfect, certainly do help in the prevention of dermatitis.

Dr. R. T. BRAIN: The only regrettable point is that these bases are rather expensive. I understand that they cost about 5s. a lb., and as ordinary hospitals bases cost about 5d. a lb. that means a tremendous addition to out-patient dispensing costs. So I reserve the use of these ointments for the scalp. I would, however, like Dr. Mumford to correct me if the price I have mentioned is wrong. I should like to hear that it is 1s. instead of 5s. a lb. because it certainly has definite advantages over soft paraffin.

Dr. MUMFORD: I am not the commercial representative of Messrs. Halden and am therefore not to blame for the price. Mr. Holden tells me that if an adequate quantity is ordered the price is 3s. a lb., and I think if sales increase the price will rapidly drop to somewhere near the price of vaseline. At present the firm is trying to exist on the benefit of sales obtained from free samples.

Multiple Punctate Telangiectasia and Purpuric Lichenoid Papules.—ELIZABETH HUNT, M.D.

E. E., widow, aged 64. Admitted to hospital with rash of a few weeks' duration over lower part of trunk, genitalia, and lower limbs. Had suffered from pruritus vulvæ, varying in intensity for from eight to ten years, but had not sought advice till the rash developed and the anus also became involved.

On examination.—Patient high coloured and obese. Rash more marked on lower part of trunk and lower limbs, and consists of tiny flat-topped red papules and numerous punctate telangiectases, almost indistinguishable from one another.

On admission.—Vulva and regions around genitalia were much inflamed and swollen and showed slight scaling. Ankles very slightly œdematous. Patient complained of recent dyspnœa on exertion. No gross change detected in myocardium. Blood-pressure 140/85. Wassermann reaction negative. Blood group II.

Blood-count (21.11.38): R.B.C. 4,900,000; Hb. 100%; C.I. 1; W.B.C. 6,000. *Differential:* Polys. 57·5%; lymphos. 31·0%; monos. 6·5%; eosinos. 3·5%; basos. 1·5%.

Platelets (30.11.38) 72,000 per c.mm. Coagulation time three and a half minutes. Spleen not palpable. Numerous septic stumps present in mouth. Urine: A few blood-cells; heavy growth of *B. coli* on culture. Vitamin-C deficiency. No occult blood in stools. Basal metabolic rate within normal limits. No monilia found in scales.

Treatment.—Septic stumps extracted. Patient given calcium-gluconate. Urinary infection yielded to mandelic acid. Redoxan given for vitamin-C deficiency.

The skin showed definite improvement, but relapse occurred soon after patient's discharge from hospital.

A similar type of eruption has been described by Gougerot and Blum [1] under the title Dermite lichénoide purpurique et pigmentée, and a case reported by Wise and Wolf [2].

The eruption has some resemblance to Schamberg's disease but differs clinically and histologically. The papules which characterize it are distinctive and do not occur in Schamberg's disease. Some of these papules are purpuric, and their purpuric character seems to me to differentiate them clinically from the papules of lichen planus.

The intertriginous condition under the breasts, in the folds of the abdomen, and around the genitalia, did not appear to me to be caused by the eruption but was definitely aggravated as a result of it.

References.—1 GOUGEROT and BLUM, *Arch. Dermat. & Syph.*, 1929, **18**, 555. 2 WISE, F., and WOLF, J. *Arch. Dermat. & Syph.*, 1935, **31**, 445.

Discussion.—Dr. A. D. K. PETERS: I should like to ask what is the clinical value of vitamin-C deficiency as shown by biochemical tests in conditions other than scurvy. Professor Amy Fleming and I have found vitamin-C deficiency to be present in a small group of patients suffering from various vulval conditions. While repeated tests had shown that this had been overcome by large dosage with vitamin C maintained over a period of several months, only one case had improved and the condition completely cleared up. In the majority of cases tests seemed to indicate a subclinical deficiency that was part of a general malnutrition that was not in direct causal relationship to the pathological condition present.

Among others, the work of Frinkle was of interest in this connexion.

Dr. F. PARKES WEBER: I think that the red spots are not simply punctate single telangiectases, as the spots in true cases of angioma serpiginosum. Microscopical examination would be interesting, because there has been great confusion between angioma serpiginosum (which to my mind is a true punctate telangiectasia) and such conditions as Schamberg's disease and Majocchi's disease.

White Spot Sclerodermia with Facial Hemiatrophy.—BERNARD W. HUNT, L.R.C.P., M.R.C.S. (introduced by Dr. H. W. BARBER).

H. R., male, aged 38.

Eight years ago the patient became sunburnt on his right arm and trunk, and afterwards he noticed that these areas became more deeply pigmented and flecked with white spots. The pigmentation has not cleared up and has tended to spread. Three years ago all his teeth were removed on account of pyorrhœa, and during the fitting for his dental plate he first noticed wasting of the left half of the face.

Clinical findings.—Patches of white spot sclerodermia on abdomen, chest, back, right arm and left face. Wasting of all muscles of left side of face and of left sternomastoid muscle; loss of hair in left eyebrow; wasting left side of tongue. Loss of subcutaneous tissue beneath pigmented patches. Blood-pressure 130/85.

Special investigations.—Blood Wassermann and Kahn reactions negative.

Lumbar puncture: No abnormality.

Basal metabolic rate: By carbon dioxide method = + 28%; by oxygen method = + 18%. Both results outside the normal variation allowance.

Total twenty-four-hour excretion of urine: Total volume 1,010 c.c. Creatine: 0·00 grm. Creatinine: 0·68 grm.

Dr. PARKES WEBER: I would like to point out in connexion with this case that there is a disease, as members doubtless know, called lipodystrophia progressiva, and in that disease the patients—usually women—gradually tend to look like skeletons in their heads and upper portions

of their bodies. Progressive facial hemiatrophy, however, tends to become still more skeleton. like, because the fat disappears from the orbit. It seems clear that the cause of lipodystrophia progressiva, which nobody has yet found out, must be different from the cause of the condition known as progressive facial hemiatrophy.

Schaumann's Disease in Two Sisters.—H. MacCormac, C.B.E., M.D.

I.—Mrs. F. S., aged 54.

History of eczema on and off since childhood affecting hands and feet, of which traces are now present. Otherwise nothing of note as regards general health. About fifteen years ago a small red spot was observed on the left buttock. This has gradually extended to form a considerable red infiltrated plaque. During the following years numerous other similar lesions have gradually appeared on the skin of the upper arms, right buttock, thighs and legs, and outer margin of left foot. All present the same characters, viz. dark red or mottled infiltrations of varying size, having a lupoid appearance. The tip of the nose is occupied by a lesion which corresponds to lupus pernio. A characteristic fusiform swelling of the left ring finger is present.

Tonsils not enlarged. Liver and spleen palpable; slightly enlarged glands in axillæ and groins. Visual defect complained of, but eyes reported normal by Mr. R. A. Greeves. Blood-count: Slight simple anæmia, otherwise within normal limits. Mantoux test negative.

Radiological examination.—Hands and feet: No clear areas. Chest: Normal movement of diaphragm; considerable enlargement of hilar shadows and increase in pulmonary striæ on both sides. Three small characteristic nodules in left upper zone representing deposit in lung substance.

Sections were made from an older and from a more recent lesion. In the older lesion there was a considerable fibrosis and only a sparse deposit of epithelioid cells, indicating a healing process. In the recent lesion characteristic masses of epithelioid cells without caseation separated by fibrous bands were visible. Giant cell formation was not a feature of the cellular reaction.

This case presents in an unusually complete degree the manifestations of Schaumann's disease, cutaneous and visceral. Only eye symptoms are lacking. Since she has been under observation an improvement in the eruption has been noted, and a second radiological examination of the chest shows a less intense degree of the abnormal pulmonary striæ. In a disease characterized by a prolonged course and a tendency to spontaneous cure, it is difficult to assess the value of the remedies used in treatment. A course of gold injections was given in Nottingham and recently, following Dr. A. M. H. Gray's suggestion, she has been treated with sodium morrhuate.

II.—Miss E. M. G., aged 61, sister of Mrs. S. General health has been indifferent. The first lupoid patch appeared on the buttocks about fourteen years ago; subsequently other lesions developed on nose, arms, thigh, and region of right great toe. All the lesions are characteristic of Boeck's sarcoid but are less pronounced and less extensive than in the first case. As this patient was first seen immediately before the meeting there has been no opportunity for a fuller investigation. The presence of the disease in two sisters must be extremely rare. Dressler has recorded a similar occurrence (Dressler, M. (1938), *Schweiz. med. Wchnschr.*, 68, 417).

Sarcoid followed by Lupus Erythematosus.—H. MacCormac, C.B.E., M.D.

Mrs. C. B., seen in May 1937, with a large raised oval dark red infiltrated patch on the right cheek of nine months' duration. The centre was somewhat flattened, resulting in a sort of ring formation. There was nothing of importance in the personal or family history, and the Wassermann reaction was negative. Following a series of four intravenous injections of novarsenobillon, each 0·3 grm., the lesion on the

cheek entirely disappeared. On November 24, 1937, a small typical patch of lupus erythematosus appeared on the tip of the nose. Otherwise the skin of the face has remained normal and there has been no recurrence of the original sarcoid-like infiltration.

The diagnosis of sarcoid was made on clinical evidence alone ; it was in this sense indistinguishable from Boeck's larger type. The interest lies in the subsequent development of the lupus erythematosus, which suggests that the original lesion has a similar ætiology to lupus erythematosus although morphologically of the sarcoid type.

Urticaria Pigmentosa treated with Grenz-rays.—W. N. GOLDSMITH, M.D.

D. F., male, aged 30.

History.—First seen May 1938. The eruption had been present for eleven years and during that period had not greatly altered. The spots come up into wheals when he is hot. No other member of the family affected ; parents not related.

On examination.—Profuse, typical eruption over trunk and limbs, especially back, flanks, and inner aspect of thighs. Individual lesions rather smaller than in the classical infantile form ; but pigmentation very conspicuous, more so than is usual in adults.

Treatment.—As I knew of no other effective remedy I decided to try Grenz-rays, and the patient is shown to-day in order to demonstrate the encouraging result. Before treatment the left flank was, if anything, slightly worse than the right flank and was, therefore, chosen as a test area. To-day the treated left flank is seen to be practically normal in comparison with the untreated right flank. Treatment of this area began in August 1938 and the last exposure was in November 1938. During this period of eleven and a half weeks he had five exposures. The dose ranged from 660 r to 975 r. The reactions varied greatly in intensity but never amounted to more than a fairly brisk erythema and moderate scaling. This was allowed completely to subside before another exposure was given. It is interesting that since beginning treatment he has found that the tendency to urtication has diminished all over the body.

? Kaposi's Multiple Pigmented Sarcoma.—W. N. GOLDSMITH, M.D.

R. L., male, aged 37.

Present condition.—The disorder involves symmetrical areas around the two ears, being most intense in front of them and being worse on the left side. On this side the upper part of the pinna is clearly involved and the condition can be traced in a faint degree behind the ears, tending to complete a circular band about 1 in. wide. The most striking clinical feature is the slaty bluish-brown colour. The skin is slightly thickened and a little scaly. On diascopy most of the slaty colour disappears and coarse irregular flecks of brown pigment remain.

History.—I first saw him in December 1938. The trouble had started three months previously with the gradual development of redness and tenderness after shaving. The latter had diminished but the colour had gradually darkened and the surface became scaly. His scalp had always been scurfy. At the age of a few months he had had a severe extensive eczema and since then had had an eruption on his fingers in the spring and summer regularly until a few years ago.

I made a diagnosis of seborrhœic dermatitis but was puzzled by the slight greyish discoloration which I thought might be due to some application. In January 1939 the colour had got much deeper and I now made a diagnosis of Kaposi's multiple pigmented sarcoma.

Biopsy (Dr. W. Freudenthal) : Parakeratosis in many parts. Marked intercellular œdema leading in a few places to the formation of small vesicles. Permeation of leucocytes.

The tips of the papillæ are œdematous and are forming small vesicles in many places. The border between epidermis and cutis is ill-defined. In the upper third of the cutis is a dense infiltration consisting of numerous fibroblasts, lymphocytes, a few plasma cells, and newly formed dilated capillaries. A few patches of a similar infiltration is seen in the middle of the cutis.

Pigment in the basal layer is increased and a good amount of melanin in coarse granules is present in the infiltrated area. Nowhere iron-containing pigment.

Treatment.—On February 10, 1939, I gave him X-rays 95 kv., 320 r, and ordered arsenic trioxide gr. $\frac{1}{20}$, t.d.s.

Dr. W. FREUDENTHAL: The result of the biopsy was inconclusive. Kaposi's disease could not be entirely excluded, although the absence of iron pigment is very unusual. Lupus erythematosus was a possibility, but the section does not show the typical picture.

Monilial Stomatitis.—R. D. MOYLE, M.D.

Mrs. L. P., aged 51.

Three years ago her dentist noted a white patch on the tongue. She was referred to the East Ham Memorial Hospital for consultation. Seen by Dr. M. Shaw, 12.3.36, W.R. negative, a diagnosis of superficial glossitis was noted and she was given a mouth wash. She was not seen again till 12.8.38. The tongue has continued to be sore all the time. On examination the tongue was nearly coated with membranous white patches with bright erythematous margins. On the left side of the tongue there was an irregular oval area about $\frac{1}{2}$ in. in length superficially ulcerated and slightly indurated. On the tip was seen a round patch with a thick grey hairy coat. White patches of membrane were present on the gums and over the buccal mucosa. This membrane could be easily removed with a spatula. Microscopically the membrane consisted of a network of long non-septate mycelia and debris. From this time until January 1939 she used various lotions, viz. pot. chlorate, sodium biborate, liq. arsenicalis, and tinc. ipecac. The condition improved, the red margins faded, the ulceration healed, and the hairy patch became less prominent. In January of this year there was an acute exacerbation, the tongue became very sore, and the membrane spread rapidly over the tongue, gums, and mucosa. In some places the membrane was raised, suggesting blebs, but this may have been merely a loosing and detachment of the membrane leaving small areas of superficial ulceration. The Wassermann reaction being repeated, was negative. The question of lupus erythematosus or lichen planus was considered. There were no other lesions on the body to give any aid in diagnosis. The general health had all the time been excellent. Following this a course of bismostab and later of nicotinic acid was given, without any improvement. She has lately been using lotio d'Alibour and lotio pot. permanganate. Two weeks ago a further microscopical examination revealed non-septate mycelia as before.

Discussion.—Dr. A. C. ROXBURGH: I think Dr. Moyle's case is probably lichen planus of the tongue. I saw a case extremely like it a few months ago in which a great part of the tongue was involved, so much so that the man was refused by an insurance company because they thought he had leukoplakia of the tongue. I found some typical lichen planus on his left ankle.

Dr. SEMON: I regard this as an example of lichen planus of the tongue, and advise a trial of thorium X locally applied in a varnish, 1,000 electrostatic units at three weeks' intervals. By this means I have recently succeeded in curing a patient (demonstrated to the Section previously, January 1938, *Proc. Roy. Soc. Med.*, **31**, 478 (Sect. Derm., 39)), who had resisted all other lines of treatment, including X-rays.

Dr. L. S. KLEEBERG: I have used thorium X for many years in the treatment of lichen planus of the mouth and it has proved most effective (200-500 e.E. *pro die* in aqueous solution as a gargle).

Siberian Ulcer.—F. JACOBSOHN, M.D.

O. W., female, aged 28, had five years ago in Siberia an ulceration on the left leg which healed slowly within three months and left some scarring. Her Russian doctors told her that this type of ulceration was frequent in Siberia ; they called it " Siberian ulcer ".

In November 1938 she suffered from some pain in her left leg on a sharply defined area above the old scars. A red spot appeared which broke down.

On examination (December 1, 1938).—Ulcer of the posterior inferior aspect of the left calf (2 cm. by 2 cm.). It looked like an acute cellulitis with a central core and some inflammation in the surrounding area. X-ray treatment was given (I.B. through 1 mm. Al. Fil), and within a week the ulceration became clean and showed a tendency to heal. The patient stated that she already felt that a new ulcer was starting at the distal margin. There were two tiny superficial capillaries or small veins visible which formed a nodule and during the next few days gave rise to a new ulcer. This increased in size and showed the same appearance as the first one. When this ulcer again seemed to heal, some new slightly raised vessels were detected at the distal edge and these again formed a nodule which broke down. The whole course was absolutely the same as experienced by the patient some years ago in Siberia.

Meanwhile the patient was treated temporarily with a new method of treatment by a mixture of curative gases which are drawn off from an apparatus containing a mixture of sod. iodate, sod. chlor., hexameth tetramine, quinine, ammon. chlor., benzyl benzoate and glycerine heated at 200°-300° C. in the presence of thickly tin-plated copper. This gas treatment seemed to heal the primary ulcer but did not prevent the formation of new ones. Therefore the gas treatment was stopped and more orthodox methods were tried (Unna's paste, elastoplast, zinc and castor oil, local ultra-violet light). These methods did not help either, nor was there any effect from two injections of novarsenobillon or from potassium iodide with and without mercury by mouth. Wassermann and Sigma reactions were and remained negative.

X-ray photograph of the left leg did not show calcification or anything abnormal. Urine : No sugar.

Bacteriological examination, for which I am indebted to Professor Garrod, who reported : " Pus scraped from the granulation tissue forming the base of the ulcer had the following characters—*Ziehl-Neelsen film :* no acid-fast bacteria. *Gram film* showed fairly numerous small Gram-negative bacilli, many being intracellular ; there were no other organisms except a few Gram-positive cocci. *Cultures* yield a profuse growth of an organism with the following characters : *Morphology :* short thin rod, Gram-negative, staining uniformly. *Growth :* rapid and profuse under aerobic conditions on all ordinary media ; colonies circular, smooth, and translucent ; in broth uniform turbidity. Motility—none. Biochemical reactions : Acid and a little gas formed in glucose. No change in mannite, lactose or saccharose, or in milk ; neutral red reduced ; indol formed ; gelatin not liquefied ; growth on potato colourless. I cannot identify this organism although it would appear to be the cause of this patient's lesion. It is neither a pfeifferella, a brucella, nor a hæmophilus (the three principal genera of small Gram-negative bacilli). Its pathogenicity for animals is being determined.

Animal inoculations were performed a week ago with cultures of the organism isolated from this lesion. A guinea-pig and a mouse inoculated intraperitoneally and a rabbit inoculated intravenously, remain alive and well. A rabbit inoculated intradermally developed a small pustule with some surrounding induration : this appears to be resolving."

Professor Garrod came eventually to the conclusion that the organism which he was able to cultivate is the actinobacillus. Lignières and Spitz (1902 and 1903)

showed that many cases of actinomycosis were caused not by the Gram-positive organism but by a small Gram-negative bacillus which they called actinobacillus. Their results were found by examination of cattle in the Argentine and confirmed by many authors, e.g. Higgins, Griffith, Magnusson. The actinobacillus affects cattle and swine. Ravaut and Pinoy described cases of infection in man. Lignières and Spitz could produce purulent nodules by intraperitoneal injections of guinea-pigs in which granules and clubs could be demonstrated. This result could not be obtained by other investigators. But Griffith considers the possibility that actinobacillus exists in strains of different virulence according to its geographical distribution and variation. In cattle the actinobacillus attacks mainly the softer tissues and rarely infiltrates bones although lymphatic glands are frequently affected. Actinomycosis is nowadays no more looked at as a single morbid entity. Therefore it may be at least justifiable to consider that owing to the result of the bacteriological examination the ulceration of the patient may be due to the actinobacillus. The complement-fixation test for the actinomyces group has not been done, but usually it is of little value. Unfortunately the patient cannot take iodine well. It will be tried again, perhaps in the colloidal form. For differential diagnosis we considered specific disease, diabetes, artefact. But there was no evidence for one of these causes. Neither do we believe that this case belongs to the class of cases of trophoneurotic ulcers which have been described by Kreibich and Hitschmann or to the cases of thrombophlebitis gangrænosa which Buschke has seen. The most probable cause for this patient's ulcer seems, therefore, a local infection with the actinobacillus. A primary infection with actinomyces itself is rare (1·6–3% of all cases), but it is most likely to happen in rural districts. It is frequent in all countries in special areas. How far it is known to occur just in Siberia was not possible to ascertain as access to Russian literature is difficult to obtain.

Discussion.—Dr. I. Muende: Has Dr. Jacobsohn examined the tissue histologically and, in particular, borne in mind the possibility of infection with Leishman-Donovan bodies? Cases of cutaneous leishmaniasis have been described in the Urals in Russia.

Dr. Jacobsohn: I think a biopsy should be done and that there should be some further investigation for Leishman-Donovan bodies and other causes. If something useful comes out of that further investigation and the biopsy I will report to the Section.

Postscript.—The ulceration has decreased in size and depth after the patient took for a week tinc. of iodine, 15 ♏, t.d.s., in cream. The patient has left the country. Therefore, further investigations have not been possible. I was informed recently that "Siberian ulcer" in Russia is mostly due to the anthrax bacillus.

(A full report of Dr. R. T. Brain's case of Granuloma annulare, also shown at this meeting, will appear in a later issue.)

Section of Epidemiology and State Medicine

President—J. A. H. Brincker, M.B.

[*February* 24, 1939]

DISCUSSION ON THE PROPER SPHERE OF STATE MEDICINE

Dr. Alfred Cox: In one form or another this question has been more debated inside our profession during the last twenty-five years than any other. It is with some diffidence that I confess that the only solution I have arrived at is *solvitur ambulando*, and this may lay me open to the charge of "hedging". However, I cannot see any other answer open to a man who does not claim the gift of plenary inspiration. I should give this answer even if we, as a profession, had the decision in our own hands. But clearly it is a social as well as a medical question in which *qua* medical men we can only offer a reasoned opinion, leaving the decision to the community we serve. Without offering anything that claims to be a final solution we can, at any rate, express our opinion on the position as we see it at present.

I envy those who have no hesitations on this subject, and are sure that the proper sphere of the State in the provision of medical attendance is to make it free to all, like primary education. I am, however, unable to accept this solution, because I think that the people of this country would lose more than they would gain by it. In a world which is becoming more and more machine-made and mechanized, in which the individual tends to become more and more swamped in the mass, it seems to me a good thing, indeed an imperative duty, whenever we can, to keep our profession, and the rights and privileges and welfare of the individual, free from the shackles of standardization—a condition which is the inevitable result of Government control. Nowhere is such an effort so necessary as in those countries which profess to believe in freedom of thought and action, and dislike the growth of the authoritarian idea.

Our profession is rightly proud of the magnificent services it has given to the community through our Public Health Services. In dealing with people in bulk, operating Acts of Parliament and regulations, and with the use of auxiliaries, the civil servant, even the medical civil servant, is seen at his best. The mark of the good civil servant is never to go beyond his instructions, to play for safety and, if possible, the approval of his superior officers. It is by exhibiting these qualities that our State and municipal medical officers have created and so well carried out the traditions of their service. But I submit that the very qualities which distinguish the medical official make him unfitted to deal with the individual. The attitude of a patient in trouble who comes to his doctor for help is not at all the attitude in which he ever approaches a State or municipal officer—nor should it be. One man specializes in mass medicine, the other in individual medicine.

Individuality seems to me to count for as much in our profession and its relations with the public as in any walk of life known to me. We deal with individuals at a time when they are more aware than usual of their purely personal and individual needs. We deal with them successfully in proportion to the degree in which we can enter into and sympathize with their mental as well as their physical conditions.

There will, in the near future I feel sure, be more and not less State aid for medical attendance.

Every Government has to face the problem of how to keep the nation contented by providing or helping to provide those necessary things on which contentment

depends. Medical attention is one of them, but it is much too expensive to be within the reach of a large section of our people. I remember the time when every general practitioner was, in theory and in practice, supposed to be able to provide all forms of medical diagnosis and treatment, except for operative cases. At the present time nobody believes this. A *full* medical service can only be obtained by the rich or through charity, and I refuse to accept charity as a solution. Even now our voluntary hospitals are depending more and more on contributory payments which are a form of insurance.

This leads me to what I believe to be the best way of solving the problem of providing medical attendance with or without Government assistance. I want the individual to feel he is, as far as possible, providing this himself. We are all apt to value most what we know we are paying for, and we value it more when the payments are direct and therefore felt. I believe that in the near future the bulk of our population will get their medical attendance of all kinds through some form of insurance, and obviously this must, for many people, be State-aided. There are thousands of people, not by any means poor, or only relatively so, who go without medical attendance until a crisis arises, simply because they dare not face the expense.

The example of National Health Insurance shows that the proportion of the cost borne by the State, as distinct from the insured person and his employer, need not be great; and the smaller the State contribution the less warrant for State control. You need go no further than our Universities, or the Medical Research Council, for proof that a moderate amount of State aid is not incompatible with freedom in the essentials.

As at present advised, therefore, the answer I give to the question in debate is this: The proper function of the State so far as the actual provision of medical attendance is concerned, is to leave it as far as possible to a free profession dealing with a free people; to encourage the profession and people to make voluntary arrangements where practicable, preferably on an insurance basis; to make such arrangements compulsory where the voluntary principle does not work; to aid financially those citizens who cannot provide entirely for themselves; and to keep the "dead hand" of officialdom as far off as possible. I want to make progress without impairing some of the most precious gifts possessed by the ordinary man, namely, the desire to help himself, to be independent, and to be regarded, not as a mere cog in the State machine, but as a self-respecting and, so far as possible, a self-maintaining citizen. In this way of approach I believe we shall not only be doing the best we can for our potential patients and for our profession—which can only operate to its maximum capacity as a *free* profession—but also for the community as a whole, by making it clear that in the field of medicine we desire to minimize State control because it is likely to officialize our profession and consequently lessen its usefulness to the individuals who form the community.

Dr. Andrew Topping: If present conditions can be shown to be wrong in theory and inefficient in practice, the need for change becomes obvious. I will try to put before you in the first place what I consider to be some of the weaknesses of the existing medical system of this country. It is obvious that much generalization is necessary and that my comments certainly do not apply to all public health authorities, general practitioners, or consultants, although I am firmly convinced that they are applicable to a distressingly great majority.

General practice is gradually becoming, instead of the high-souled profession that it ought to be, a rather unethical trade in which each man vies with his fellow in the attempt to get more and more patients with the accompanying increase in income. We are taught as students never to treat symptoms and never to diagnose a condition without the fullest possible investigation. In practice, as it is to-day, the vast majority of patients who seek advice are labelled debility, influenza, muscular

rheumatism, or anæmia, on the " look and say " method ; they are given a bottle of medicine and left to Mother Nature who, luckily, cures the majority even in spite of the bottle of medicine. Dr. R. Hutchison said in a recent lecture, " So few indeed are the diseases we can really cure that one is tempted to believe that if all doctors went on strike for a year the effect on the death-rate would be inappreciable. In most cases of illness the doctor is really a mental poultice ". It is a distressing thought that with all the worth-while work in prevention of disease, in the recognition of its earliest manifestations and in scientific methods of treatment the justification for our existence should be that we are like a well-known brand of cocoa, " grateful and comforting ". And it is not necessarily the most efficient doctor who is the best mental poultice ; there is a premium now on the doctor who has the gift of unctuous blarney. The keen man who makes a painstaking examination and suggests bacteriological or X-ray investigation is often thought to be over-fussy. It is unreasonable to expect men to remain keen in their professional work when, through no fault of their own, they are becoming mere clearing houses for all but the most trifling ailments. The development of specialism for every organ and malady ; the necessity for scientific research into the cause of an illness ; the need for elaborate equipment—X-ray, biochemical, &c.—for diagnostic purposes ; the provision of hospital beds for so many diseases ; all these make it increasingly difficult for the doctor to do much more than see a case and advise where it should be taken for treatment. He has lost almost all venereal disease work. Every year he gets fewer confinements ; he rarely treats a case of fever—his function is to diagnose, and to notify the case for removal to hospital ; knowledge of infant care has so increased that the number of babies brought to him for treatment is immeasurably reduced. Most cases with even a minor surgical complaint are sent to an out-patient department ; heart cases should be sent for electrocardiographic examination ; he is not encouraged to treat his own chest cases ; it is obviously better to send them to the Tuberculosis Dispensary where they will be X-rayed, have their sputum tested, and be examined under the best possible conditions.

I cannot see any indication that these services will cease to cover such a large field—indeed the probability is that they will extend. It has to be admitted that these facilities are of great benefit to the health of the individual and to the community. But the net result of such specialization is going to be not only a lowering of the status of the practitioner but of his income and his self-respect. Something must be done, and the only solution that I can see is that the practitioners should become more and more identified with State medicine.

So much for the state of much general practice to-day, particularly in large industrial areas.

Is the consultant branch in a healthy condition ? Why is it essential for a first-class doctor to live in the Harley Street area ? The benefits of concentration are far outweighed by the disadvantages both to the consultants themselves and to their patients. It is not convenient for hospitals, for transport, or for car parking, and rents are ridiculously high.

When the embryo consultant has got his plate up in the approved area there is no guarantee, even assuming that he is a really first-class man, that he will reap a reward, either in money or in the opportunities to do good medical work commensurate with the sacrifices he has made in getting there. So here we have men who, presumably, are the pick of the profession, living a hand-to-mouth existence for an indefinite number of years with no security and no guarantee of getting even a reasonable reward in the end.

It is not only in the realms of private and consultant practice that there is room for improvement and rationalization. Public Health and Municipal Hospital Services suffer from the parochial nature of their control. Each authority has its own junior medical staff, many of them engaged whole time in a circumscribed speciality, with

nothing approaching the opportunities for transfer, promotions or variations in work which would exist in a national service.

It is clear that the crux of the whole situation is financial. Under existing conditions, therefore, a State Medical Service should be our aim.

The history of medical practice in the last thirty years shows that it can be done. Sickness benefit under the Insurance Acts is being extended to children between 14 and 16; in many towns there is a service for the wives and families of insured persons. Those below insurance limits are given medical attention by district medical officers; and the health of workers in factories and industry is the care of the Home Office. Actually, therefore, it is not a very great step forward to offer medical service to all the population.

Control of the service must be entirely non-political and must be in the hands of medical men recruited from all branches of the profession.

Dr. Frank Gray: There are three points on which I would lay special stress:
(1) The economic difficulty.

(2) The general lack of co-ordination of medical services, and especially the gap between preventive and curative medicine.

(3) The materialistic outlook. The effect of a patient's mental state on his health is now beginning to be generally recognized, but can we say that just as no treatment should be undertaken before we have made an examination of the patient's bodily condition, so the same statement applies to his mental condition also?

Efforts to change these arrangements are needed from the State and the local authorities, the medical profession, and the community in general.

As regards the State, in the past the undoubted successes which it has achieved have chiefly been in dealing with the community as a whole, and in adapting the environment (including the economic environment) to fit the individual rather than adapting the individual to fit the environment.

The chief point of controversy is whether the State should take a large section of the medical profession into a salaried service. In considering this question I am bound to admit that the strongest argument in favour of a salaried service is the medical service of the London County Council. There is a striking contrast between the quiet efficiency of the L.C.C. hospitals and the much-boosted efforts of those institutions which always welcome an out-patient who does not need hospital treatment, and often fail to provide a bed for an in-patient who does.

Unfortunately there are other salaried services besides those of the London County Council, and we must glance—with a kindly eye—at some of the characteristics of those services, particularly of the Government departments. The essential feature of such a service is, of course, the salary and the consequent security, and hence the chief characteristics of Government departments is—belief in Government deparments, coupled with a certain contentment. With this contentment goes naturally rigidity and inertia; if all is well, why try to improve it? It is a remarkable fact that though we have had National Health Insurance for over twenty-five years, and a Ministry of Health for twenty, the only post-graduate instruction in preventive medicine for general practitioners has been organized by two groups of London doctors, and not by the Ministry.

Government officials are essentially reasonable people but, as Bernard Shaw has pointed out, all progress depends on the unreasonable people. Nothing is done without stirring up trouble, and the chief object of a Government servant is to avoid stirring up trouble. The absence of progress is stagnation.

Then there is the impersonal attitude. Knowing as we do how intimate are the matters which our patients discuss with us, can we believe that they would confide in a State servant? Would any of us discuss our personal problems with our inspector of income tax?

The best preventive work cannot be done on the fee per attendance basis, because of the economic difficulties, the unwillingness of the public at present to pay for preventive advice as a separate item, and the unconscious bias of the doctor who stands to gain financially from each separate illness. There should be an extension of health insurance, the State doing the organization and compulsion (and personally I believe that the income limit will eventually have to be raised to at least £500 a year), whilst leaving much of the control of the service to the medical profession itself. The cardinal points of the service would be that the doctor's remuneration did not depend on his patient's ill-health, that it did depend on the number of patients who attached themselves to him, and that there was free choice of doctor by patient, and patient by doctor.

Dr. E. R. C. Walker: In 1934 the Scottish Committee of the British Medical Association undertook on behalf of the Association the preparation of a Memorandum of Evidence to be presented to the Scottish Committee on Health Services. Early in the course of this task we became convinced that all along the development of our health services had suffered greatly from a failure to understand and appreciate the principles underlying the problems of health and sickness. We surmised that the influence of the sciences of morbid anatomy and pathology, predominant in medical thought for at least a century and, of course, productive of great advances, had in many respects been misleading. We stated this opinion thus: "It may be said that until comparatively recently modern medicine found its inspiration and sanction in the sciences of pathology and morbid anatomy. The careful study of pathological processes and of their causes is, of course, an essential part of the elucidation of the problems of disease, but it tends to concentrate attention on the phenomenon to the exclusion of the human organism exhibiting it. Recently a reorientation of medical thought has occurred and the basis has been widened. In the modern wider concept medicine has come to be regarded as applied human biology. From this point of view the state of health of an individual at any time is the measure of his success in reacting to his environment. It is our opinion that many of the present-day health measures are misdirected, for the very reason that they are based on what for convenience may be called 'the pathological conception of disease'." From the standpoint of evolutionary biology we can accept the proposition that the State is an organization that has arisen and is evolving in response to fundamental human needs. It is in all likelihood a mechanism which man has devised in an attempt favourably to alter his environment. In so far as it succeeds in doing this it will be stable and secure.

Clearly there are two sides to this equation. The State and its individual members are mutually supportive and have a reciprocal duty. The more successful the State in fulfilling its function the greater will be the mass of individual well-being or health. The greater the proportion of healthy individual members the more successfully will the functions of the State be fulfilled.

If we accept, too, the biological conception of health, then it follows also that medicine, which by definition is the art and science of restoring and maintaining health, is most certainly and completely the concern of the State. My answer, therefore, to the question "what is the proper sphere of State medicine?" is, that it is the entire field of medical activities.

If we grant the validity of the argument so far, there still remains the question of what type of organization the State ought to plan and evolve. In my opinion the proper plan has not yet been devised. It is not the rigid Civil Service plan, however gradually introduced, nor is it the scheme propounded by the British Medical Association. The extension of the National Health Insurance Scheme—the central proposal of the Association's plan—would be a thoroughly unwise step. Firstly, it is not properly a "health" service but a sickness service. Secondly, the financial arrange-

ments involved in certification of sickness complicate and vitiate the proper relationship between patient and doctor. My third point of criticism is the most important, in that it is inherent in the scheme and cannot be modified as the others might. It is this, that while the system of a contracted *per capita* payment may be a quite suitable one when applied to selected groups for particular purposes, as a method of remunerating the executives of a nation-wide service it is thoroughly unsatisfactory. The system lays an improper commercial bias on the service. To begin with the need for capital outlay, where it does not actually exclude, at any rate severely handicaps much of the best talent. The existing capitation fee is grossly inadequate for a proper service and leads to the vicious practice of undertaking too much work and not doing it properly. Recent arbitration experience does not suggest that extension of the Insurance Scheme would do anything but extend this inadequacy.

The best plan would be like the State Medicine Scheme, a salaried service, and, like the Insurance Scheme, it will embody the principle of free choice; but much more than either it will ensure that purely medical administration is left in the hands of the medical profession.

Mr. Somerville Hastings: There is no limit to the proper sphere of State Medicine. In my view there is no rational stopping place between the first incursion of the State into the sphere of preventive medicine, and a complete State Medical service.

If it is true to say that to prevent we must treat, it is equally true that to treat efficiently we must first diagnose. The general practitioner, therefore, who sees the earliest beginnings of disease, must of necessity be brought into a State Medical Service, and this is also essential because the earlier disease can be attacked, the more efficient is treatment likely to be.

If insurance were compulsory, I can see no essential difference between the payment of medical attention by means of insurance and by a tax or rate. If, however, insurance is to be voluntary, then the people most in need of medical attention will not trouble to provide it for themselves. It does not matter very much to the community whether most of the services usually provided by insurance are obtainable or not, but it is a matter of importance to all that every individual should have the best medical attention obtainable when required.

Dr. C. F. White: Neither the State nor the municipalities ever took over a service which was being efficiently provided by private enterprise. Only when private enterprise had failed to supply an essential public need did central or local Government authorities step in.

It is evident that to an increasing degree it is impossible for private medical practitioners to supply the medical needs of the community and therefore to an increasing degree the State must take over the obligation.

A State Medical Service is not only inevitable but desirable. At the same time the ideal should be to ensure that every case of illness is seen in the first instance in the patient's own home by his own family doctor. Only thus could factors, psychological, hereditary, and environmental, having an important bearing on diagnosis and treatment, be observed.

The importance of free choice of doctor is over-stressed. Choice is in any case usually fairly limited, and proximity probably exerts more influence than anything else in the making of a selection for the first time. Once a choice has been made patients will, however, go to a great deal of trouble to keep their own doctor.

Under a State Medical Service the " high spots " might not be so high as under the fierce competition of private practice; but the " low spots " would certainly never be allowed to be so low, and I think the average standard of medical practice would be a good deal higher than it is at present.

Section of Medicine

President—H. L. Tidy, M.D.

[*January* 24, 1939]

DISCUSSION ON ANOREXIA NERVOSA

Professor John A. Ryle: Whether we can conclude from the increased output of papers bearing on the subject of anorexia nervosa that the incidence of the malady itself has risen or merely that it is receiving more frequent recognition and closer study I cannot say. When I last reviewed my material in 1936, it included 55 private cases seen within a period of thirteen years. Since then, I have seen a further eight cases in private practice and three or four others under the care of colleagues at Addenbrooke's Hospital. The maximum number of private cases seen by me in any one of the last fifteen years was 12 (in 1932), the minimum one (in 1927 and 1937), and the average four. Excepting that 19 cases were referred to me during 1931 and 1932, my own experience does not suggest a recent fluctuation in incidence. Reading the case histories I could discover no common factor to explain the higher figures in those two years. The spread of the slimming fashion, now happily on the wane, and the more emotional lives of the younger generation since the War might have been expected to provide a general increase, but these influences may well have been counteracted by the growth of a healthy athleticism among girls and young women and the greater freedom from restraints which they now enjoy.

Historical

So far as the history and literature of anorexia nervosa are concerned we should remind ourselves that Richard Morton [10] described an indisputable case in his little book on Phthisis in 1694; that Thomas Hobbes, the philosopher, gave an account of his visit to a case which was quoted by Samuel Gee [8], who himself gave a concise picture of the disorder under the title of "nervous atrophy" in his well-known Medical Lectures and Clinical Aphorisms; and that Clifford Allbutt [2], Lockhart Stephens [14], Hurst [9], Venables [15], Conybeare [4], Allison and Picton Davies [1], Ross [11], and Sheldon [13], in this country, have made notable contributions to the subject, which was also chosen by me for the Schorstein Memorial Lecture [12] in 1936. The best account in the French literature is probably that of Déjerine and Gauckler [5]. Abroad there has clearly been confusion of late years between anorexia nervosa and the organic syndrome of pituitary cachexia or Simmonds' disease. Over and above all other descriptions, however, we must still hold Gull's [7] and [8] portraiture of the malady (now 70 years old) in highest esteem, and to him we owe both the name, which I have shown good reasons for retaining, and the generally accepted view that the anorexia and its associations and consequences depend upon a morbid mental state.

Ætiology

According to my observations, 90% of the cases are in women, and of these 70% are in girls and young women below the age of 30. Of these, nearly all are unmarried. My youngest patient was aged 14½. The average age in the youthful female group was 20. In my older female group the ages ranged from 31 to 59, the average age being 44. The ages in the male group ranged from 19 to 34, with an average age of 25.

The majority of cases may be classified as psycho-neurotic, but there are borderline and graver cases which might be classified, as Ross has suggested, as anorexia

psychotica. The adjective " nervosa " is, however, sufficiently comprehensive to include both groups. Dr. C. P. Symonds has suggested to me that in a certain proportion of cases the nervous anorexia is an early manifestation of cyclothymia. We need a more careful analysis of family histories and after-histories than has yet been available to support this view, which I am nevertheless inclined to accept. It should be remembered that a family history of a depressive psychosis does not exclude the possibility of other coincident nervous traits, and an ill-defined nervous heredity is common in anorexia nervosa. The emotional instabilities of young adult life play an important part in ætiology. Of initiating or contributory factors, other than slimming in response to teasing on the score of adolescent plumpness (and this can rarely be accepted as a sole cause), love affairs, broken engagements, school attachments and jealousies, home sickness (especially in the case of girls sent abroad), unhappy home life, spoiling by devoted parents, mental shocks, examinations and overwork, and convalescence from a physical illness or operation are all noteworthy.

Perpetuating factors include morbid enjoyment of the interest and anxiety aroused by the illness, the sense of power over the mother obtained thereby, and a temperamental (or maybe symptomatic) exaggeration of the sense of duty with which there are often associated a restless activity and a tendency to the performance of good works and fussy actions on behalf of others. Although they may be " devoted to each other " mother and daughter are frequently " at loggerheads " or " on each other's nerves ". The lack of a diagnosis must also be accepted as a common perpetuating factor.

Physical illness and operation and menopausal ill-health would seem more frequently to provide the background for the malady in patients of the older group.

Clinical Picture

The clinical picture of the fully developed case (and we should remember that the earlier stages too often pass unrecognized) is that of a young woman presenting the appearance of more or less advanced starvation. The bony points are prominent. The abdomen is scaphoid. The face is thin but the colour is usually retained. There is a fine downy hirsuties on the cheeks, the forearms, and the back. On the abdomen the hair often shows the male distribution. The pulse is slow, the blood-pressure low—often 100 mm. (systolic) or below—and the temperature is subnormal. The loss of weight may be anything from 1 to 4 st. Amenorrhœa is nearly constant. Emotional derangement in the form of moodiness, tantrums, or tears, is not far to seek and is usually reported by the mother, although the patient may appear natural and even cheerful at a first interview.. Subterfuge in the disposal of food and concealed vomiting may create difficulties and call for careful watching. In contrast with these striking physical findings and in spite of extremely inadequate diets there is rarely any evidence of anæmia or deficiency disease. A degree of activity of mind and body which would be impossible in the presence of emaciation due to any of the organic wasting diseases is often remarked, but is not invariable. Diagnosis should not be difficult. In the words of Déjerine and Gauckler [5] " Or le diagnostic de l'anorexie mentale est extrêment simple ; il suffit d'y songer." I do not believe that there should as a rule be any serious difficulty in differentiation from Simmonds' disease, which is a rare condition, but this aspect of the subject I shall leave to Dr. Sheldon and Dr. Spence. Bruckner, Wies and Lavietes [3] have recently considered the difficulties in differentiation which may arise and have carefully studied the distinctive features.

Prognosis

Both Ross [11] and Venables [15] have shown that with sensible institutional treatment the prognosis of anorexia nervosa in young women is almost uniformly good. The younger the patient in my experience the better the result, partly, perhaps,

because the diagnosis is more quickly made, partly because the psychological disturbance is usually of simpler type, and partly, maybe, through the natural resilience of childhood. Home treatment is commonly unsatisfactory on account of the mother-daughter relationship. Nevertheless, approximately one half of my cases did well with home treatment. In cases of long standing, treatment is less easy and prognosis less certainly happy. A few cases recover incompletely to the extent that the restoration of weight and appetite are only partial, amenorrhœa persists, and the young woman remains " difficult " and " different " through life. The fatal cases have commonly been diagnosed late and treated inadequately. Some of them should probably come within the psychotic group. Among the 37 cases (out of 55) which were followed up in the series reported in my Schorstein Lecture there were four deaths. The causes of death include simple starvation and starvation complicated by tuberculosis. One of my patients died with a hæmorrhagic purpura and was earlier reported as having shown signs of scurvy. I have recently seen a fatal case under the care of Dr. Whittle at Addenbrooke's Hospital, in which a confluent hæmorrhagic eruption, unlike anything which I have previously seen, appeared all over the chest and abdomen together with vomiting due, as was shown at necropsy, to acute duodenal ileus from kinking of the duodenum over the preternaturally sharp edge of the root of the mesentery. Emaciation from other causes has been known to predispose to duodenal ileus and the possibility of this condition as a physical basis for vomiting in anorexia nervosa should clearly not be forgotten. Of my five male cases three recovered and engaged in full active life again ; one improved slowly but incompletely ; one died of tuberculosis of the lungs.

Treatment

Treatment consists in firm and kindly handling and insistence on an adequate food intake from the beginning. The patient should be kept in bed at first and, whenever suitable arrangements can be made, away from home. I have seen no reason to employ insulin, small doses of thyroid, or other endocrine preparations, or to allow periodic fast days as advocated by Allison and Picton Davies [1]. I have no experience of vitamin B injections. Such treatments overlook the fact that " the want of appetite " as Gull insisted, " is due to a morbid mental state " and that the treatment of starvation is feeding. Elaborate psychiatric methods are undesirable, but a simple, straightforward explanation and reassurance so framed as to convey the impression that the situation is fully comprehended and that the treatment must be accepted and will produce the desired recovery may be as important as any of the other details of treatment. The mother and daughter should be separately interviewed.

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Dr. J. H. Sheldon: Although the English literature on anorexia nervosa presents quite a tranquil surface, there is a very considerable ferment of opinion going on in American and Continental literature, and some attempt has to be made to integrate what appear at first sight to be two quite sharply contrasted points of view.

The English tradition of anorexia nervosa is entirely a development within the original framework of ideas provided by Sir William Gull, and it has for its central tenet the view that the disease is not organic, but arises from what Sir William Gull himself described as a " morbid mental state "—in other words it arises in response to some emotional or mental need, and just because I shall be devoting myself entirely to the physical aspects of the disease I am anxious at the outset to express my entire acceptance of this point of view and to say that in my judgment no account of anorexia nervosa can be even remotely adequate which fails to take cognizance of this as an essential background to the clinical features presented by the patient.

A further tenet of the English tradition is that the clinical features of the established disease are the simple result of starvation—though no one seems to have posed the question as to why starvation should produce the symptoms it actually does. In one respect, however, this is demonstrably wrong. I refer to the amenorrhœa. In between a third and half of the cases this arises at either the same time as the anorexia or even before it, and it cannot possibly then be attributed to starvation. The menses may cease suddenly as the result of mental strain or of shock in healthy women, and if proof of this be required one need only refer to the recent work of Macgregor [1] who found that among the first-year nurses at the Edinburgh Royal, no less than 29% had during the first year of their training an amenorrhœa of from one to ten months' duration. Such a functional amenorrhœa is accompanied, as one might expect, by a diminution or total absence of excretion of sex hormones in the urine. I think we are entirely justified in transferring this to anorexia nervosa, and regarding the condition there as an " amenorrhœa nervosa ". The fact that in these cases a psychological cause leads—presumably via the hypothalamus—to a suppression of hormone output from the anterior pituitary lends an initial support to the view I expressed in 1937 that the symptoms of anorexia nervosa might be explained as a sort of functional Simmonds' disease, though, as will be seen later, I no longer regard this as an adequate statement. The English tradition has also, I think, to find room for a constitutional tendency—at any rate in the cases occurring in puberty. There is evidence that a proportion of these cases were abnormal before the onset of the anorexia—usually showing evidence of a failure of growth, either bodily or sexual.

Turning to the foreign literature the first thing to note is that the original papers of Gull [2] and Laségue [3] had little influence outside their countries of origin, and in particular they remained almost entirely unknown in German-speaking countries. Indeed up to about 1930 anorexia nervosa seems to have attracted no special attention in Germany and it appears to have been regarded merely as a curiosity in the department of hysteria. Thereafter interest in the condition suddenly became active. This was due to two factors, partly to the growth of knowledge of the wide range of activity of the anterior pituitary, but mainly to the gradual popularization of the description by Simmonds [4] of the clinical effects in the human being following destruction of the anterior pituitary. As these gradually coloured the background of medical thought, so physicians suddenly woke up to the fact that there were in their midst large numbers of young women who were not only extremely wasted, but who at times actually died of their wasting. Starting *de novo*, knowing nothing of anorexia nervosa, it is not surprising that seen through such spectacles the cases were regarded as instances of organic disease. Two things happened. In the first place, large numbers of cases were described, and are still being described, in all good faith, as instances of Simmonds' disease. In actual fact there are over 80 instances of this mis-reporting and approximately half of the published cases of anorexia nervosa are indexed under other names. At the same time certain observers,

shrewder than the rest, noticed that these cases were not quite the same as those belonging to the classical type described by Simmonds, and these tended to think that they were dealing with a new disease. In actual fact the disease has been rediscovered and renamed four or five times since 1930. Falta [5] in 1928 described it as primary anorexia, and he thought that the defect of appetite was attributable to a defect of the insulin mechanism. In 1935 Korbsch [6] considered it was caused by a primary atrophy of the gastric mucous membrane. In the same year Wahlberg [7] in Scandinavia labelled it as asthenia gravis hypophyseogenea, and in 1936 Krause and Müller [8] labelled it severe anterior pituitary weakness. The most industrious of these was Kylin [9] of Sweden. In 1935 he wrote a monograph on Simmonds' disease which will always be one of the more important papers on anorexia nervosa. By 1937 he had come to realize that these cases were different from the classical form of Simmonds' disease, and so he renamed it himself. He would have liked to call it pituitary hypobasophilia, as he found a deficiency of basophil cells at post mortem, but thinking that it was probably not quite so simple he called it by the cumbrous title of " wasting of late female puberty, a disease form *sui generis* ".

The problem we are therefore presented with is this—how is it that so many observers—men like ourselves except that so far as they are concerned Sir William Gull might never have existed—how is it that they universally regard the condition as organic and with almost complete unanimity incriminate the anterior pituitary as the cause of the disease ? In some fashion we have to incorporate into the English way of looking at anorexia nervosa an adequate explanation for such a widespread error.

This is best done, I am sure, by examining the physical symptoms of anorexia nervosa in the light of what occurs in both Simmonds' disease and starvation. These three conditions have the following physical features in common : (1) loss of weight, (2) amenorrhœa, (3) lowered basal metabolism, (4) alterations in carbohydrate metabolism, (5) subnormal temperature, (6) slow pulse, (7) hypotension. So far as Simmonds' disease is concerned, I have taken into account only the cases with a pure destructive lesion of the pituitary, cases caused by infarction after labour. The facts, so far as starvation is concerned, are taken partly from the experiments of Benedict [10] and others on professional fasters, but wherever possible from the literature of famine, for this presents the closer similarity to what is found in anorexia nervosa. I shall not deal with each symptom separately, but merely state that there are no essential differences between either of the three conditions in any symptom. If one notes the widespread agreement, covering so many different fields, cardiovascular, sex, heat production, metabolism, and so on, I think one is justified in saying in the first place that the agreement is far too close to be a matter of mere coincidental similarity. Considering only starvation and Simmonds' disease—since anorexia nervosa is *sub judice*—one is forced to the conclusion that at some stage a common path is used in the production of these symptoms. If this be the case it is very important to remember that the starting place in point of time in the case of Simmonds' lies in an actual destruction of most of the anterior pituitary, while the starting place in the case of starvation lies in a lessened intake of food. This being the case it seems justifiable to advance the hypothesis that the varied changes found in starvation are not a series of haphazard peripheral effects, produced locally in this or that tissue by a mere diminution of food supply, but are a series of co-ordinated changes produced by a central mechanism adjusting the body to a lowered intake of food. Bearing in mind the past history of life on this earth, it seems inherently probable that some such mechanism would in the course of time have been evolved. It would appear, therefore, that such a mechanism—and the fact that similar mechanisms for dealing with heat and cold are situated in the hypothalamus would suggest a similar localization—acts primarily and chiefly by a general inhibition of anterior pituitary activity. The immediate recovery with normal feeding after starvation shows that the changes are

not due to an actual destruction of the pituitary cells. Such a general inhibition of anterior pituitary activity would lead to the same clinical picture as the diminution caused by actual destruction of the gland cells, and this would explain the close similarity between starvation and Simmonds' disease. Writers on anorexia nervosa speak usually of the effects of starvation as if no other explanation were required than the mere use of the word, but this is clearly insufficient, and I suggest that the similarity between the two states is as close as it is because the body adjusts itself to a lowered food intake by an immediate decrease in anterior pituitary activity—in other words by producing a functional Simmonds' disease. At the moment, therefore, it is merely a question of words whether one regards the signs of anorexia nervosa as being a functional Simmonds' disease or as being due to starvation.

There is one symptom, however, in which anorexia nervosa departs from Simmonds' disease. An increased growth of hair has never been described in any of the case-reports of Simmonds, whereas it is frequent in anorexia nervosa. The usual finding is a growth of downy hair on the trunk and limbs, while on the face the hair is masculine in tendency, with downy hair on the moustache area, and coarser hairs on the beard region. I have had great difficulty in finding what happens in famine, but I recently came across the following quotation from a lay observer describing what he saw in what I take to have been the great Irish potato famine of 1845 [11]. The Rev. Canon Bourke, of Claremorris (quoted by Curran), said, " I saw hundreds of children, from the ages of 2 to 12, with hair on their skinny arms and cheeks fully one inch long, a false growth caused by decay and hunger. A lad of 12, whose cheeks were wan as those of a corpse, invested with the cerements of the grave, and who presented all the usual features of chronic starvation, exhibited this peculiarity in a striking manner. The lad's arms were covered throughout with downy hair ". That exactly parallels what is found in anorexia nervosa, and in this respect, therefore, the disease departs from Simmonds' and follows starvation. This increased growth of hair supports my suggestion that the body adapts itself to starvation by a series of co-ordinated and not haphazard local changes—for this growth of hair has an obvious teleological significance—to assist in preserving the body heat. It is also worth noting that if one attributes it to some increased activity of the suprarenal cortex, then the intersexual features of the hair growth, which are also found in starvation, may be regarded as an unnecessary but inevitable by-product of this activity, and it is worth noting that alone among the endocrine organs, the suprarenal gland enlarges during starvation, and was found by T. R. Elliott [12] as long ago as 1914 to be remarkably well preserved in anorexia nervosa. The physical changes in anorexia nervosa are therefore identical with those of starvation, and if one regards the latter as the result of a co-ordinated mechanism which in many respects involves a great diminution of anterior pituitary activity, one can readily understand why anorexia nervosa is so universally regarded abroad as an organic endocrine disorder. Since such an explanation in no way disagrees with the view that the origin of the starvation is psychological, it fits in readily enough with the English tradition, and it is difficult to see any other way in which the two points of view can be brought together.

I would say, therefore, that in response to an original cause on the mental plane, there is a loss of appetite and in some cases a simultaneous cessation of menstruation due to a direct nervous inhibition of sex hormone activity in the anterior pituitary. The lowering of food intake sets in motion a mechanism which acts mainly by a reduction of anterior pituitary activity, and therefore mimics the clinical tableau of organic disease of the pituitary.

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Dr. A. W. Spence: Anorexia nervosa presents various problems of interest to the endocrinologist. I propose to deal mainly with the endocrine aspect of the condition, and to present for your criticism a few thoughts on the mechanism whereby the disturbances of the endocrine system are produced.

At the outset I must stress that I do not consider anorexia nervosa to be primarily a disease of the endocrine system. I agree with the previous speakers that the initial disturbance is psychological, the manifestations of endocrine dysfunction being purely secondary. These may be so prominent that the condition may be, and often is, mistaken for Simmonds' disease. In fact, when discussing a patient with anorexia nervosa with a physician from Germany, I was informed that in that country the term anorexia nervosa is not recognized, and that the patient in question would be considered to be suffering from Simmonds' disease. The syndrome described by Simmonds, however, is in my opinion a rare condition, the diagnosis of which is frequently uncertain until autopsy, but milder forms, described by von Bergmann (1934) as pituitary emaciation, are more common. In passing, I would suggest that pituitary emaciation is a better term for these milder cases than Simmonds' disease, as they do not conform to the picture originally described by Simmonds. The symptom-complex of anorexia nervosa and pituitary emaciation is often indistinguishable, but in looking through the literature on the subject, I have found a number of cases labelled pituitary emaciation which, in my opinion, would have been more correctly diagnosed as anorexia nervosa. The differentiation between the two conditions rests mainly on the discovery of an initial psychological factor, which is responsible for the loss of appetite in anorexia nervosa.

The mechanism whereby a psychological disturbance causes loss of appetite is not clear. Hunger, however, depends on the muscular contractions of the empty stomach, but after a few days of fasting, hunger contractions cease (Cannon and Washburn, 1912). Ross (1938) has drawn attention to the fact that hunger is related to a fall in the blood-sugar level (Bulatao and Carlson, 1924). He has pointed out that partial starvation at once leads to impaired glucose tolerance, and that if hunger contractions are dependent on a low level of the blood-sugar they will cease at the higher fasting level which is present in impaired tolerance, and consequently hunger will fail. This accounts for the emaciation which sometimes affects obese subjects who have undergone slimming.

The occasional appearance of amenorrhœa before anorexia has been used by some writers as one argument in favour of anorexia nervosa being primarily an endocrine disorder. As menstruation is dependent on the delicate balance of ovarian hormones, the secretion of which is controlled by the anterior pituitary, amenorrhœa, in the absence of a general debilitating condition such as anæmia, is necessarily of endocrine origin, but in anorexia nervosa not necessarily of *primary* endocrine origin, as it is for instance in a patient with a chromophobe adenoma of the pituitary. There is anatomical evidence that nerve-fibres pass from centres in the hypothalamus to the pituitary, and it is suggested that the secretion of pituitary hormones is a response to stimuli from these centres (Beattie, Brow and Long, 1939). Ovulation and pseudo-pregnancy have been induced in animals by electrical stimulation through the head

(Harris, 1936 ; Marshall and Verney, 1936), and Theobald (1936) has produced clinical evidence to show that the regularity of the menstrual cycle probably depends on the passage of nervous impulses from a menstruation centre in the hypothalamus to the anterior pituitary. It is well known that even the slightest psychological disturbance may cause amenorrhœa. It is conceivable that the outflow of impulses from the hypothalamic centres to the pituitary are inhibited by a disturbance of the higher centres. One calls to mind that a similar sequence of events may be sometimes responsible for the production of diabetes insipidus. There is thus no reason why amenorrhœa should not precede anorexia as a symptom of disturbance of the higher centres.

After the anorexia has become established, I feel that the endocrine features can be explained in terms of vitamin deficiency. A likely cause of the amenorrhœa, in addition to the psychological disturbance, may be the deficient intake of vitamin E. Rowlands and Singer (1936) have found that the pituitary gland of rats fed on a vitamin-E-deficient diet contains a decreased amount of the gonadotrophic hormone which causes luteinization of the ovarian follicles. Barrie (1937) has drawn attention to the similarity of the effects of hypophysectomy to those produced by vitamin-E deficiency, and suggested that the two phenomena may be related. She found that in rats fed on a vitamin-E-deficient diet the anterior pituitary contained a large number of agranular cells ; the eosinophil cells were small and degenerate, and the thyroid was hypoplastic. Ovulation and œstrous cycles were apparently normal, but in one animal whose mother was partly E deficient the ovaries showed no normal follicles. Barrie concluded that vitamin E is necessary for the normal function of the anterior pituitary, and that in E-deficient rats the secretion of gonadotrophic and thyrotrophic hormones is impaired. Admittedly, so far as animal experiments indicate, and these have been conducted mainly on the rat, vitamin E is directly concerned with only one phase of the female reproductive process, namely the blood supply and nutrition of the embryo, but it is well known that the reaction of different species, not only to pituitary hormones, but also to vitamin deficiency, varies considerably. I feel, therefore, that in view of the marked changes demonstrable in the anterior pituitary of vitamin-E-deficient rats, one should seriously consider whether an additional cause of the amenorrhœa in anorexia nervosa may possibly be the deficient intake of vitamin E, resulting in impairment of anterior pituitary function, deficient secretion of gonadotrophic hormone, and consequently defective formation of the corpus luteum and diminished secretion of progesterone. The estimation of the output of pregnanediol in the urine in this condition would be of considerable interest.

In addition, deficiency of vitamin A has been shown to prevent the characteristic action of gonadotrophic hormone (Aberle, 1933), so that deficiency of vitamin A may also play a part in anorexia nervosa by preventing the action of whatever gonadotrophic hormone is secreted.

A prominent feature in anorexia nervosa is the low basal metabolic rate, a usual finding in undernutrition. Lusk (1928), who observed this in professional starvers, suggested that it was an innate protective mechanism, the nature of which one could only dimly surmise. This view was supported by Berkman (1930), writing on anorexia nervosa, but as Dr. Sheldon (1937) has pointed out, it does not take into account the mental and bodily activity which is so common in these patients. Reference has already been made to the thyroid hypoplasia and changes in the anterior pituitary in vitamin-E-deficient rats. Similar thyroid changes were found in vitamin-E-deficient rats by Singer (1936), who also concluded that the proper functioning of the pituitary undoubtedly depends in some degree on the presence of vitamin E in the tissues. I put forward the suggestion that a deficiency of vitamin E, acting through the anterior pituitary and diminishing the output of thyrotrophic hormone, may be responsible for the low basal metabolism in anorexia nervosa.

So far we have considered only the effect of vitamin deficiency on the anterior pituitary, without reference to its effect on the receptor glands, such as the thyroid and ovaries, which the anterior pituitary stimulates. Extracts of anterior pituitary or of pregnancy urine or progesterone do not prevent the reproductive failure in rats fed on a vitamin-E-deficient diet (Mattill, 1938), so that it appears that in the absence of vitamin E in the tissues these hormones are unable to exert their usual action. With regard to the thyroid, a deficiency of vitamins has a definite effect on its structure and function. Some years ago I showed that in the rat vitamin-A deficiency produces considerable keratinization of the thyroid epithelium, with a fall in basal metabolism in some of the animals (Spence, 1932). In vitamin-B deficiency the specific dynamic action of protein is not observed, probably owing to diminution in thyroid secretion (Arvay and Verzár, 1928). Singer has observed that in vitamin-E-deficient rats the thyroid response to even large doses of anterior pituitary extract is surprisingly small. This has been my experience in a patient with anorexia nervosa. The administration of thyrotrophic extract of the anterior pituitary to normal man results in a prompt rise of the basal metabolic rate within twenty-four to forty-eight hours, but in the patient with anorexia nervosa little response was obtained with 2 c.c. of ambinon (400 Heyl-Laqueur units) a day for eight days.

The response of an organ to a hormone depends not only on the activity and dose of the preparation, but also on the sensitivity of the organ to the stimulus. Thus, before a certain age the ovarian follicles are incapable of responding to injections of the follicle-stimulating hormone (Smith, Engle and Tyndale, 1934). It is suggested that the tissues of the patient in question were deficient in some substance (? vitamin A and/or vitamin E), an adequate amount of which is necessary to maintain the responsive capacity of the receptor organs, e.g. the thyroid. This may perhaps be the reason why I have found hormone treatment disappointing. The administration of thyrotrophic extract, the follicle-stimulating extract of pregnant mare's serum and œstradiol benzoate, has failed to bring about the slightest improvement. It did not occur to me at the time, about eighteen months ago, to determine the effect of thyrotrophic hormone after giving full doses of vitamin E, and since then the opportunity has not recurred.

If it is true that these patients are suffering from vitamin deficiency, the keratinizing action of vitamin-A deficiency on the thyroid epithelium and the impairment by vitamin-E deficiency of the capacity of the thyroid to respond to thyrotrophic hormone are further reasons why the basal metabolism is low in anorexia nervosa. On the other hand, it is remarkable that these patients never demonstrate the more severe nutritional disorders—scurvy, beri-beri, nutritional œdema. It is possible that the endocrine system is more sensitive to vitamin deficiency.

I do not propose to say much about treatment. As the disorder is primarily due to inability to take food, initially because of a mental upset, and later perhaps because of impaired sugar tolerance in addition, treatment should be directed to improving the mental state and encouraging the patient to eat. The diet should not be bulky, and should consist largely of carbohydrate to bring the fasting blood-sugar to a lower level, in the hope that thereby hunger contractions will be initiated. Some of my remarks on the mechanism of anorexia nervosa have been somewhat hypothetical, as I have not yet had the opportunity of putting them to a practical test, but for the reasons I have suggested it would be well worth trying the effect on the endocrine disturbances of full doses of vitamins, especially of vitamin E.

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Sir Arthur Hurst: In anorexia nervosa the loss of appetite itself is generally due primarily to some psychogenic cause. Sometimes, however, it is secondary to a voluntary restriction in the intake of food, again due to some psychogenic cause, but in this case the anorexia results from the physiological fact that the appetite varies with the intake of food, the anorexia being the natural sequel of an insufficient diet. Whether the anorexia is primary or secondary to a diminished intake of food it is likely to continue indefinitely unless the patient makes a voluntary effort to overcome it, as the longer the abstention from food remains the more pronounced is the resulting anorexia.

It is clear, therefore, that the logical treatment is to reverse the process and to overcome the anorexia by persuading the patient to eat. It is quite unnecessary at this stage to tackle the primary psychological troubles, and such accessory treatments as the use of pituitary or ovarian extracts, insulin, vitamins, or special diets, are also quite unnecessary. Treatment is extremely difficult at the patient's home and hardly less difficult in the general ward of a hospital, but comparatively easy in a nursing home. We have had the opportunity of treating about 50 cases at New Lodge Clinic since 1921 and without exception they have done well.

The patient is made to realize that the physician fully understands her difficulties. She is told that in spite of her nausea, loathing of food and discomfort on eating she must eat, as it is only by eating that she can re-educate her appetite. It was lost by fasting; it will be restored by eating. The process will be uncomfortable, but it can and must be carried through. After one long conversation a full meal is given, and the patient is not left until the whole of it has been consumed. There must be no time limit for this first meal; resistance is often extreme, but it can always be overcome with patience and good temper. After success with the first meal progress is generally uninterrupted. Resistance still occurs in many cases, but it becomes rapidly and progressively less. In a severe case it may be necessary for the physician to be present at one meal a day for the first week or fortnight, but the management of the remaining meals may be left to an experienced nurse.

When the appetite is returning and the patient is eating full meals without difficulty, the psychological problems which led to the anorexia may be discussed, but this is not always necessary, as in many instances they have been forgotten in the severity of the illness that followed or they have solved themselves by the time the patient has come under treatment. A few straightforward conversations are sufficient to reveal and straighten out most mental tangles. No form of deep analysis is ever required.

The ultimate prognosis is excellent. I have never seen a case in which the cure of the anorexia was followed by the substitution of some other hysterical symptoms. Several of our cases date from ten or fifteen years ago, and so far as I know there has been no recurrence. The worst case I have ever seen, a boy aged 19, who was almost moribund on admission and so weak that he could not speak above a whisper or raise his head or arms, made a perfect physical and mental recovery, and now, seventeen

years later, he is a successful business man with a family of three children. He was the only case in which a full diet could not be given, as he was not only too weak to feed himself but was also firmly determined to take no food of any kind if he could help it. A tube was passed through his nose into his stomach and milk from a concealed retainer was run in by the drip method continuously day and night for five days, by which time he had recovered sufficient strength to feed himself and sufficient sense to agree that the taking of food was not a sin and that life was worth living.

Dr. S. W. Patterson: In a series of 273 patients observed at Ruthin Castle in whom the main or a prominent symptom was loss of or grossly lessened appetite, it was found that organic disease of the stomach (ulcer, carcinoma, gastritis, or the after-stages gastro-enterostomy) which may interfere seriously with the appetite, accounted for one-quarter of the cases. In one-eighth of the patients reviewed, appetite was much diminished reflexly from disease elsewhere in the alimentary tract originating in the lower bowel, carcinoma of colon or rectum even in the early stages before asthenia or exhaustion from pain occurred, colitis especially ulcerative, or affections of the gall-bladder, cholecystitis, gall-stones.

The largest group, just under one-half, consisted of toxic, infective, and general states. Of these one-third follow the breakdown of cardiorenal cases, congestive failure or uræmia; one-half are due to anæmia, arthritis, infections of urinary tract, phthisis, and other infections; a few fall into a degenerative group, with the waning powers of senescence. In an endocrine group of 10 cases, seven were related to the thyroid; two were cases of myxœdema, one had a goitre pressing on the trachea, and four were cases of Graves' disease. All did well on treatment, the first two with thyroid extract, the others with the surgical removal of the excess of gland substance. Two were related to cessation of ovarian function rather than to neurosis. One was a diabetic, in whom the distaste and monotony of strict diabetic diet produced starvation and anorexia. This may be compared with a patient who began dieting himself for intolerable migraine, becoming vegetarian, reducing his weight, and ending with distaste for food and anorexia.

Nervous factors accounted for one-fourth of the cases: psychoses, anxiety, and neurasthenic psychoneurosis, and the type (in nine patients of the series) recognized as anorexia nervosa.

Local—		
Peptic ulcer, atrophic gastritis, gastro-enterostomy	26	
Alcoholic gastritis	21	
Carcinoma	16	
	—	63
Reflex—		
Colon or rectum (colitis, carcinoma)	19	
Gall-bladder, cholecystitis, gall-stones	14	
	—	33
Toxic—		
Cardiorenal	37	
Chest (phthisis, carcinoma)	10	
Anæmia (secondary, Addisonian, Hodgkin's)	16	
Carcinomatosis	4	
Arthritis	9	
Pyelitis	7	
Other infections (malaria, shingles, antrum)	9	
Endocrine (menopause, diabetes, thyroid)	10	
Degenerative	7	
	—	109
Nervous—		
Psychotic	14	
Strain	28	
Anxiety	17	
Anorexia nervosa	9	68
	—	—
		273

The psychotics are in a group by themselves, but I think it is justifiable to divide the other cases of functional anorexia into those with anxiety neurosis, those with nervous exhaustion or strain, and anorexia nervosa in the restricted sense. Usually there is a history of anxiety, strain, or disappointment and emotional conflict.

Very few of these cases are in our experience endocrine in origin. As in the War, the breaking strain of individuals varies greatly, and after a breakdown it often takes a long time to pick up. In most cases institutional treatment is advisable; the nursing care and the feeling that all worries are shouldered by someone else, at least for the time being, are a great help. The essential form of treatment is by improving the nutrition; this may be done both by reducing the expenditure of energy—these patients are usually ceaselessly active and should be rested in bed with mild sedatives at first—and by increasing the diet, giving small frequent meals of concentrated foods.

In all three groups the psychological aspect must be taken into account. In the group brought about by strain, the rest, relief from work, may be enough, but rest has to be promoted by sympathy and sedatives; in the group with anxiety, much reassurance is needed; in the true anorexia nervosa, during the stage which is almost mental, firm but kindly discipline is required.

Dr. Henry Yellowlees associated himself with the remarks of the previous speaker, and pointed out that they gave some little indication of the infinitely complex and important state of affairs underlying what had been rather glibly summarized as "the mother-daughter relationship". He was surprised that, after the earnest emphasis laid by all three openers upon the essential "psychological factor" in causation, the references to the treatment of this factor had consisted in little more than a warning to avoid "elaborate psychotherapy" and an exhortation to "speak kindly but firmly to the patient". He fancied he had heard these words before.

He said that, in the majority of cases, anorexia nervosa was a symptom of hysteria—using that word in its proper sense—and he contrasted it with the refusal of food that might occur in practically every psychosis, and also with the similar but, as he thought, quite distinguishable syndrome of "pituitary cachexia" or Simmonds' disease.

He pointed out that no reference had been made to the widely differing effects of starvation or limited intake of food in different circumstances, e.g. in famine, in anorexia nervosa, and for therapeutic purposes.

Dr. F. Parkes Weber said that in severe cases of anorexia nervosa it seemed to him almost criminal to waste time in anything like psycho-analytical investigations (however interesting they might be) at the commencement of treatment.

Section of Odontology

President—A. H. Parrott, O.B.E., M.D.S.Birm.

[*February* 27, 1939]

Bacteriæmia and Oral Sepsis

By S. D. Elliott, M.B.

Abstract.—Transient streptococcal bacteriæmias are a frequent sequel to dental extractions especially when the mouth is the seat of severe chronic gum infection. Bacteria may also gain admission to the blood-stream in such cases irrespective of operative procedures and probably as the result, in many instances, of minor degrees of gum injury such as is produced by biting on a loose tooth. Acute apical infections do not appear to be especially associated with blood infection of this kind, the focus of infection here apparently being effectively " walled off " by the associated inflammatory reaction.

Of the two factors, infection and trauma, involved in the production of these post-operative bacteriæmias, infection appears to be the more important since, when it is marked, very slight degrees of gum injury are sufficient to produce blood-stream invasion. In the complete absence, however, of the type of trauma induced by the " rocking " of a tooth during its removal, extraction may be accomplished without producing a heavy bacterial shower in the blood.

Usually these transient bacteriæmias produce no permanent ill-effect, but there is some evidence that, occurring in subjects with abnormal heart valves, they may lead to subacute infective endocarditis. Thirteen cases are reported where the valvular infection appeared to result from a post-operative dental bacteriæmia.

Prevention of such bacteriæmias may be achieved by the reduction or elimination of infection and trauma. Complete elimination of the gum infection is difficult although preliminary treatment of the gum margin by some measure such as cauterization may lessen it and lead to a reduction of the post-operative bacterial shower. Similarly, by manipulating an infected tooth as little as possible during its extraction the incidence or degree of blood infection may be decreased.

Résumé.—Les extractions dentaires sont souvent suivies de bactériémies streptococciques passagères, surtout en présence d'une infection grave chronique des gencives. Les bactéries peuvent aussi atteindre la circulation indépendemment de toute intervention chirurgicale, probablement souvent comme suite de légers traumatismes des gencives, tels que ceux qui se produisent en mordant sur une dent branlante. Les infections apicales aiguës ne semblent pas être associées spécialement avec ces bactériémies, car le foyer d'infection semble être " emmuré " par la réaction inflammatoire qui les accompagne.

L'infection semble être le plus important des deux facteurs, l'infection et le traumatisme, qui produisent ces bactériémies, car, si l'infection est grave, un traumatisme très faible des gencives suffit pour amener l'invasion du sang. Toutefois, dans l'absence complète du traumatisme produit par le " balancement " d'une dent pendant l'extraction, l'opération peut être accomplie sans produire d'émission sérieuse de bacilles dans le sang.

En général ces bactériémies passagères ne produisent pas de dommage permanent, mais il y a des raisons pour croire que quand elles suviennent chez des sujets avec des valvules cardiaques anormales elles peuvent être suivies d'endocardite infectieuse subaiguë. L'auteur rapporte 13 cas où l'infection valvulaire semble être la suite d'une bactériémie dentaire post-opératoire.

Ce genre de bactériémie peut être évité par la réduction ou l'élimination de l'infection et du traumatisme. L'élimination complète d'une infection gingivale est difficile, mais celle-ci peut être diminuée par des mesures préliminaires telles que la cautérisation du rebord gingival, ce qui diminue l'émission postopératoire de bactéries. La fréquence et la gravité de l'infection du sang peuvent également être diminuées en évitant toute manipulation inutile d'une dent infectée pendant son extraction.

ZUSAMMENFASSUNG.—Zahnextraktionen werden häufig von einer vorübergehenden Streptokokken-Bakteriämie gefolgt, besonders bei schweren chronischen Zahnfleischinfektionen. In solchen Fällen können Keime auch unabhängig von operativen Eingriffen den Blutstrom erreichen, öfters wahrscheinlich infolge leichter Zahnfleischverletzungen, wie sie beim Beissen auf einen lockeren Zahn vorkommen. Akute Apikalinfektionen scheinen nicht besonders mit Blutinfektionen dieser Art einherzugehen da der Infektionsherd anscheinend durch die begleitende entzündliche Reaktion " abgesperrt " ist.

Von den beiden Faktoren, Infektion und Verletzung, die diesen postoperativen Bakteriämien zugrunde liegen, scheint die Infektion der wichtigste zu sein, da bei starker Infektion ganz geringe Verletzungen genügen, um eine Blutinvasion zu erzeugen. Bei völliger Vermeidung von Verletzungen, die durch " Schaukeln " eines Zahnes während der Extraktion erzeugt werden, kann die Extraktion ohne grosse Ausschwemmung von Bakterien in das Blut ausgeführt werden.

Während diese vorübergehenden Bakteriämien gewöhnlich keine Dauerschädigungen zur Folge haben, können sie bei Kranken mit abnormen Herzklappen nachgewiesenermassen zu subakuter infektiöser Endokarditis führen. Es werden 13 Fälle mitgeteilt, bei denen die Herzklappeninfektion anscheinend die Folge einer postoperativen dentalen Bakteriämie war.

Solche Bakteriämien können durch Verminderung oder Beseitigung von Infektion und Trauma verhütet werden. Eine restlose Beseitigung der Zahnfleischinfektion ist schwierig, obwohl sie durch Vorbehandlung des Zahnfleischrandes mittels Kauterisation oder einer ähnlichen Methode vermindert werden kann, so dass die postoperative Ausschwemmung von Bakterien vermindert wird. In ähnlicher Weise können die Häufigkeit und die Schwere der Blutinfektion durch möglichst geringe Manipulation bei der Extraktion eines infizierten Zahnes vermindert werden.

Sources and Contributory Factors in Production of Bacteriæmia

THE conception of bacteriæmia, that is, the presence of bacteria in the blood-stream, has for long provided a convenient working hypothesis in explaining the mechanism by which secondary infective lesions are produced in the body at a distance from a single primary focus ; yet it is remarkable in how comparatively few instances in these conditions there is direct bacteriological evidence of blood-stream invasion. In conditions where an infective process is in intimate relationship with the blood-stream—as in an acute suppurative thrombophlebitis—it is easy enough to imagine how a bacteriæmia will occur. In more chronic conditions, however, when a local inflammatory reaction has resulted in an attempt by the surrounding tissues to " wall off " the focus of infection, ingress of bacteria into the neighbouring blood-vessels and thence into the general circulation cannot always be assumed to occur in the absence of some other contributory factors.

Experimental work with animals summarized by Haines (1937) has shown that bacteria are frequently to be found in the blood without apparently producing any ill-effects. The organisms often gain entrance into the blood-stream from some part of the alimentary tract and contributory factors influencing the production of a bacteriæmia have been found to be starvation, fatigue, and the nature of the diet. Similar apparently innocuous bacteriæmias have been observed in man although here the determining factor has usually been observed to be trauma applied to a focus of infection. Seifert (1925) investigated a large series of cases in which there had been interference, either operation, re-examination of wounds, or changing of dressings in an infected area. Transient blood-stream infections were shown to occur in 45 out of 78 acute infections but in only 12 out of 67 chronic infections. It is worthy of note that he found operations on bones to be especially liable to be succeeded by a

bacteriæmia. Similarly Lehmann (1926) recovered bacteria, in this case *Cl. welchii*, from blood cultures made immediately following curettage in 18 out of 100 consecutive abortions, while Barrington and Wright (1930) showed that manipulations of the urinary tract, such as are produced by the passage of a catheter in the presence of infection, frequently lead to invasion of the blood-stream by *B. coli*.

Blood Cultures following Dental Extractions

The mouth provides a focus of infection frequently exposed to minor degrees of injury which might be expected to lead to bacterial showers in the blood. The evidence for the occurrence of bacteriæmia following tonsillectomy is rather conflicting although I have recently concluded an investigation on this point, as yet unpublished, which has convinced me that blood-stream infection does, indeed, frequently occur. In 1935, Okell and I published a report on the result of blood cultures made in a series of otherwise normal subjects immediately following dental extractions. 138 patients were investigated in this way, blood for culture being taken from an arm vein immediately before and within five minutes following operation. It is not easy to classify the different varieties of oral sepsis, gum and apical infections being rarely mutually exclusive conditions. Our cases were therefore divided roughly into three groups, A, B, and C, according to the severity of the gum infection and the number of teeth extracted.

TABLE I.—STREPTOCOCCAL BACTERIÆMIA FOLLOWING EXTRACTION OF TEETH IN 138 CASES.

Case group	Type	Cases examined	Result of blood culture after extractions	Streptococcal colony counts. Average of aerobic and anaerobic cultures: <1 c.c.	1-5 c.c.	6-10 c.c.	11-15 c.c.	>15 c.c.
A	Marked gum disease; multiple extraction	40	30+ 10− (75%+)	5	17	2	2	4
B	Moderate gum disease; multiple extraction	60	42+ 18− (70%+)	14	21	4	1	2
C	Without detectable gum disease; extraction of one or more teeth	38	12+ 26− (34%+)	3	9	—	—	—

+ indicates that streptococci were present in the blood culture.
− indicates that no streptococci were present in the blood culture.
c.c. = per cubic centimetre.

In Group A, those considered to be of a severe type of oral sepsis and in which a massive extraction was carried out, the post-operative blood cultures from which streptococci were recovered reached as high a figure as 75%, while in Group C, comprising patients without obvious gum infection but in whom one or two teeth were extracted on account of caries, positive cultures were obtained in 34% of cases. The organisms recovered from the positive blood cultures were nearly always streptococci of the non-hæmolytic type. The bacteriæmia was apparently quite transient: In 10 cases when a positive culture was obtained directly after extraction, a third specimen was taken at a period varying from ten minutes to eight hours after operation. After these intervals the blood was always found to be sterile.

Bacteriæmia in Relation to Dental Sepsis

The most unexpected and, in our opinion the most interesting, of our findings, was that in 12 cases streptococci were recovered from a specimen of blood taken *before* operation. All these cases were of a severe type of gum infection. We never isolated organisms from the blood taken before operation in the group of 38 clean

cases, Group C, or from control blood cultures from a group of 30 healthy young adults. Thus, in 110 cases of pyorrhœal disease 12 (10·9%) were found to have a streptococcal bacteriæmia irrespective of operative procedure. In three instances where streptococci were found in the blood both before and immediately following operation, a third specimen was taken one to six hours later, but was then always found to be sterile. One imagines that the inflammatory reaction following upon extraction closes down the field of absorption of organisms from which there had probably been a previous intermittent leakage into the blood-stream.

These results as regards bacteriæmia both before and following dental extraction have since been confirmed by numerous other workers. (Fish and Maclean, 1936, Round, Kirkpatrick and Hails, 1936, Southworth and Flake, 1938, Bulleid, A. (unpublished observations)).

Blood Cultures following Dental Manipulation

We were impressed throughout by the importance of the degree of manipulation of the teeth during extraction in determining to some extent the degree of bacteriæmia following operation and we suggested that mastication or brushing the gums might lead to a similar result. With the help of Mr. Dudley Buxton and Mr. Sinclair at University College Hospital and Mr. Rumsey and Mr. Smith at Addenbrooke's Hospital, Cambridge, I have recently been engaged in trying to establish the least degree of dental injury necessary to produce a blood-stream infection. In this way I hoped to find some link between our pre- and post-operative bacteriæmias. In this investigation two blood samples have been taken *before* extraction, before and immediately after " rocking " one tooth with forceps.

TABLE II.—STREPTOCOCCAL BACTERIÆMIA FOLLOWING DENTAL MANIPULATION.

Type of case	Number of cases examined	Result of blood-culture after "rocking" one tooth
Marked gum disease	21	18 (streptococci present) 3 (streptococci absent) 86% (streptococci present)
Without detectable gum disease	20	5 (streptococci present) 15 (streptococci absent) 25% (streptococci present)

The result in the case of septic mouths has been to produce a streptococcal bacteriæmia in 18 out of 21 cases investigated, i.e. 86% of cases. One of these cases had a positive blood culture before as well as after manipulation. In the case of clean mouths when one carious tooth has been " rocked ", five out of 20 cases (25%) have shown positive blood cultures after manipulation.

Blood cultures before dental manipulation.—In one case of severe gum infection streptococci were isolated from the blood sample taken before as well as after manipulation of a tooth. Eighteen cases of this group had sterile blood cultures before operation and in two cases blood samples were obtained only following manipulation ; streptococci were recovered from one of these cultures, the other being sterile. Of the 20 cases without gum infection, blood samples were taken before manipulation from 11 only ; all these cultures were sterile although streptococci were isolated from four following manipulation.

Bacteria other than streptococci isolated from blood samples taken before and after dental manipulation.—In three out of the 21 cases of marked gum disease, *Staphylococcus albus* was recovered in addition to *Streptococcus viridans* from the blood after manipulation of a tooth. In another case of this group diphtheroids were isolated in addition to streptococci. Organisms other than streptococci were never isolated from the blood of the cases without gum diseases.

The type of case in which a bacteriæmia has been induced with the greatest consistency has been that in which there was severe gum infection with " pocketing "

and the teeth loose to start with. In one such case a loose premolar was subjected to two lateral movements, an excursion of about $\frac{1}{3}$ in. The amount of tissue damage must have been minimal, yet a bacteriæmia was produced. It is thus easy to imagine that very slight degrees of trauma in a mouth the subject of marked gum infection are sufficient to produce blood invasion. Round, Kirkpatrick and Hails (1936) have indeed, reported positive blood cultures in two out of 10 cases following the chewing of hard sweets; this result was only produced in the subjects of marked infection. It would appear that of the two factors—infection and trauma—necessary in the production of this type of bacteriæmia, infection is the more important since it has been shown in the foregoing experiments that by reducing the degree of gum infection and inducing a constant or possibly increasing degree of trauma (since the manipulation of a carious tooth in an otherwise clean mouth usually produces more tissue damage than that of a loose tooth in a pyorrhœal mouth) the bacteriæmia rate following manipulation has been reduced from 86 to 25%. If, on the other hand, we consider cases when the degree of infection is approximately similar but where the degree of trauma to the tissues is varied, there is no comparable variation in the incidence of post-traumatic bacteriæmia. In the case of *massive* extractions in severe gum infection, bacteriæmia followed in 75% of cases; while following the manipulation of a *single* tooth in a similar case group, 86% yielded positive blood cultures. This increase in the latter group was probably due to an improved blood culture technique (Elliott, 1938), which was adopted in the manipulation experiments.

Acute apical infection.—A second line of inquiry resulting from this work has been to determine the relative importance of various types of dental infection in their relationship to blood-stream invasion. Chronic apical and surface infections are, I believe, rarely mutually exclusive conditions and cannot be easily studied apart from each other. Acute apical infections, however, do occur fairly frequently in otherwise clean mouths, and I am at present investigating the incidence of bacteriæmia in relation to this type of infection. So far, only 12 cases have been investigated, but positive blood cultures following manipulation and extraction of the tooth have been obtained in only four out of 12 cases examined, an incidence no greater than that obtained following the removal of one or two carious teeth from a clean mouth. Non-hæmolytic streptococci were recovered from the blood on three occasions and *Staphylococcus albus* once. Apparently the acute inflammatory reaction "walls off" the infected focus from the general circulation in the same way that after massive extractions it closes down the field of absorption.

Blood cultures before operation.—In one instance *Staphylococcus albus* was isolated from the blood sample taken before operation, the post-operative culture from this case being sterile. The pre-operative cultures from the remaining 11 cases were sterile.

The Remote Effects of Bacteriæmia of Oral Origin

It may be asked whether these transient bacterial invasions of the blood-stream are of any pathological significance. As regards their remote effects, they usually produce no ill result unless there is some pre-existing abnormality of an organ or tissue, such as a joint or heart valve, which renders it more than normally liable to infection. There are, I believe, orthopædic surgeons who are unwilling to allow their patients to undergo dental operations whilst the subject of acute joint lesions. There is some evidence that bacterial infection of the heart valves may follow dental operations, especially where there has been some pre-existing valvular abnormality either as the result of a congenital defect or rheumatic infection (Rushton 1930, Abrahamson 1931). What appears to be a significant proportion of patients with subacute infective endocarditis date the onset of their immediate illness from some dental operation. Of course, one has to be wary in the interpretation of such histories since dental operations are

common and subacute endocarditis correspondingly rare amongst the general population ; but I should like to bring to your attention a few cases where the history has seemed to me very suggestive.

Subacute Infective Endocarditis following the Extraction of Teeth

Since we published our paper on bacteriæmia and oral sepsis in October 1935, out of 56 patients with infective endocarditis from whom I have received cultures of streptococci isolated from blood cultures, at least 13 gave a history of a recent dental operation preceding the onset of their illness. This does not represent a true index of the incidence of a history of dental operations in these cases since in many instances such information was not sought. Of these 13 cases, however, nine were admitted to hospital with fully developed infective endocarditis within eight weeks and all within six months of dental operations, from which all 13 patients dated the onset of their immediate illness. In seven cases the extractions were massive in character, upwards of six teeth being removed at a sitting. Seven patients had a definite history of pre-existing cardiac disease, which was of rheumatic origin in six and congenital in one ; one case had a previous history of chorea.

TABLE III.—SIX CASES OF SUBACUTE BACTERIAL ENDOCARDITIS WITH HISTORIES OF DENTAL OPERATION PRECEDING ONSET OF DISEASE.

Age and sex	Previous cardiac abnormality	Previous dental disease	Dental operation	Interval between operation and onset of symptoms of infective endocarditis
28 years, male	Rheumatic carditis	Pyorrhœa	7 teeth extracted singly at weekly intervals	During dental treatment
40 years, male	Rheumatic carditis	Pyorrhœa	9 teeth extracted at 2 sittings	2 weeks
19 years, female	Patent ductus arteriosus	? pyorrhœa	12 teeth extracted at 2 sittings	Ten days
25 years, female		Caries	19 teeth extracted at 2 sittings	Indefinite < nine weeks
34 years, male	Indefinite	Caries	Dental "filling". Laceration of gum by drill	Two days
59 years, male		? pyorrhœa	9 teeth extracted at 1 sitting	Three weeks

In six cases, a more detailed history was available. These include two out of five cases of infective endocarditis in which post-mortem confirmation of the diagnosis was obtained, admitted to Addenbrooke's Hospital, Cambridge, under Professor Ryle during the last eighteen months. The first of these, a man aged 28 with a rheumatic history, had commenced having teeth extracted, singly and at weekly intervals, three months before admission. During the period of dental treatment he developed joint pains and generalized symptoms. He was admitted with a temperature of 102° F. and a positive blood culture from which a non-hæmolytic streptococcus was recovered. In the second of these cases there was also a history of rheumatism and dental extractions which had been carried out on two occasions eight weeks previously. Six teeth were removed at the first and three at the second sitting, two weeks after which the patient took to his bed. On admission there was marked pyorrhœa with several loose teeth and the man then had a positive blood culture.

For the histories of two further cases admitted to the London Hospital within the last six months, I am indebted to Dr. Rowlands and Dr. Wall. The first, a girl aged 19 with a congenital cardiac defect, gave a history of having had seven teeth extracted three weeks and five teeth two weeks before admission. She had typical signs of subacute bacterial endocarditis, a positive blood culture being obtained two days after admission. The second case, a girl aged 25, had no history of rheumatic fever or congenital heart disease, but three months before admission had 19 teeth removed in two sittings. Since then she had complained of feeling ill and had lost a stone in weight. There was a three weeks' history of joint swellings, and during

her stay in hospital she developed typical signs of infective endocarditis with a positive blood culture.

Dr. D. E. Bedford, of the Middlesex Hospital, permits me to quote two interesting cases, including one of a slightly different type, which were under his care. The first, a man aged 34, had no rheumatic history, but slight "heart trouble" had been recognized since childhood. He was in good health until, while having a tooth drilled by his dentist, the drill slipped and lacerated his gum, after which he suffered severe neuralgic pain in the face and jaw. Two days later he had shivering attacks and went to bed with a temperature of 100° F. He had a positive blood culture from which hæmolytic streptococci were recovered and infective endocarditis was diagnosed from which he succumbed. The second of Dr. Bedford's cases gave a more typical history, the extraction of nine teeth in a man of 59 being followed after three weeks by progressive weakness and loss of weight. The typical signs of infective endocarditis followed, this diagnosis being later confirmed by post-mortem examination which, however, failed to reveal any indication of pre-existing rheumatic valvular disease.

The Prevention of Bacteriæmia of Dental Origin

Can anything be done to prevent these bacteriæmias of dental origin? It seems clear that, occurring in subjects with pre-existing cardiac abnormalities, such blood infections, although transient, entail a definite risk of subsequent valvular infection. Since we know that in severe pyorrhœa slight degrees of dental trauma, such as might be occasioned by biting on a loose tooth, commonly lead to a bacterial shower in the blood-stream, it is apparent that under those conditions there is probably an almost constant intermittent leakage of organisms from the mouth into the blood. Scrupulous attention to oral hygiene would seem indicated, therefore, especially in subjects with any cardiac abnormality. Massive extractions of teeth should not be countenanced in such patients, and when dental extractions are essential, a minimum of manipulation or "rocking" of the tooth with forceps should be employed during its removal. An indication that, by avoiding preliminary "rocking" of a tooth in a badly infected mouth, extraction can be achieved without the production of a demonstrable or, at any rate, a heavy bacterial shower is suggested by two simple experiments that Mr. Dudley Buxton and I carried out. In the first case, one of severe pyorrhœa, an incisor was removed without "rocking" and with a minimum of trauma to the gums; a sample of blood taken for culture immediately after was sterile. Ten minutes later a premolar in the same case was "rocked" with forceps and a further blood sample taken before extraction of the tooth. From this latter blood culture a growth of streptococci was obtained. In the second case, also one of severe pyorrhœa, a loose lower premolar was "rocked"; a quantitative blood culture made immediately after revealed a streptococcal colony count representing approximately 58 organisms per cubic centimetre of blood. After a short interval, eight teeth were extracted from the same patient, with a minimum of manipulation which was possible here since all the teeth were loose to start with; a further quantitative blood culture made immediately after the extractions revealed approximately only five organisms per cubic centimetre of blood. These experiments suggest that the preliminary "rocking" of a tooth is immediately responsible for the subsequent post-operative bacteriæmia which may be reduced or avoided altogether by extraction without manipulation, even in cases of marked gum infection. Fish and Maclean (1936) contend that the organisms found in the blood after dental extractions probably originate in many instances from the heavily infected gum margin whence they are pumped by the mechanical action of "rocking" into the dental pulp, the apical tissues, and general circulation. They suggest, therefore, that the gum infection in the neighbourhood of the teeth to be extracted should be reduced by preliminary cauterization of the gum margin. Mr. Dudley Buxton and I have tried the effect of preliminary cauterization on the production of subsequent post-operative bacteriæmias

but only as yet in an insignificant number of cases. Five cases were treated by preliminary cauterization of the gum margin surrounding a tooth to be manipulated. The actual cautery was used and cauterization made as thorough as possible. Three of these cases gave positive blood cultures after manipulation and in two the blood was sterile. In two of the cases where a sterile blood sample was obtained the tooth involved had been a canine or an incisor, while positive cultures were obtained following cauterization and manipulation of an incisor, a canine, and a premolar.

This work was carried out during the tenure of a grant from the Harmsworth Memorial Fund.

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Discussion.—Dr. E. W. FISH said the knowledge that a bacteriæmia might follow the extraction of a tooth in a case of acute alveolar abscess was of great importance, since that was an emergency operation which one might be called upon to perform on a patient with endocarditis. In cases of simple endocarditis the patient should not be allowed to brush the teeth and gums or chew hard food. In such cases he had been in the habit of packing the interdental spaces very gently with a paste of zinc oxide and oil of cloves on wisps of cotton-wool and changing this dressing every few days. If a tooth had to be extracted the operation was preceded by a dose of prontosil and the gum margins were thoroughly cauterized.

Mr. JOHN BUNYAN said for oral hygiene he advocated rubber instead of bristle brushes. These could not lacerate and did stimulate the tissues. At the same time the patient irrigated the interdental spaces and pockets by using a glass syringe and a weak hypochlorite solution.

Section of Ophthalmology

President—MALCOLM HEPBURN, F.R.C.S.

[*December* 9, 1938]

CASES SHOWN AT THE ROYAL LONDON OPHTHALMIC HOSPITAL

Subhyaloid Œdema of the Retina.—JEAN M. DOLLAR, F.R.C.S.

R. M., aged 26. Bricklayer.

First seen 28.11.38.

History.—On waking, three days previously, patient noticed a large round blurred spot in front of the right eye, which has persisted. He stated that the right pupil had been larger than the left in childhood, but that the irregularity later became unnoticeable.

On examination.—In spite of the scotoma R.V. $\frac{6}{9}$; L.V. $\frac{6}{5}$. Right pupil larger than left. Right eye hypersensitive to light. Fundus: A circular area was seen in the macular region about 2 D.D. in size, and duller in colour than the adjacent retina. Partially surrounding the edge of this area a peculiar sickle-shaped bright linear reflex was noted changing with the movement of the ophthalmoscope, but always remaining on the periphery of the area.

The dark area could be outlined as a positive relative scotoma, almost absolute for white and blue, less dense for red and green. During the past week the condition has improved, both objectively and subjectively.

Cases of this kind have been reported for many years under diverse names. There is a good account of one by Brailey in the *Transactions of the Ophthalmological Society* fifty-one years ago (1887), and no doubt there are earlier cases still. The following are some of the names under which this condition has been reported: (1) Circular lesion of the retina; (2) abnormal reflexes of the retina; (3) pre-retinal œdema; (4) retinitis serosa disciformis; (5) chorio-retinitis centralis serosa; (6) retinitis centralis angiospastica. There is no question that subhyaloid œdema is present in these cases. The fact that the scotoma is positive puts the lesion in front of the retina. The fact that vision remains good even at the height of the attack in spite of its central situation, shows that the retina itself cannot be heavily involved. Moreover, with the Gullstrand binocular ophthalmoscope the lesion can be seen to be in front of the retina, and the reflexes that are shown up reveal the lesion as a vesicle. In almost all cases such diminution of vision as occurs can be overcome by putting up a small plus lens. In my patient vision yesterday was $\frac{6}{12}$. With a + 1 it was $\frac{6}{6}$.

The condition is well known in Japan and has been regarded as a disease almost exclusively confined to Japanese. This is not the case. The probabilities are that it happens to have been studied more carefully in Japan where it passes under the name of " chorio-retinitis centralis serosa ". That exactly the same condition has been recognized elsewhere is apparent from the pictures taken from European and American literature, some of which I am able to show to the Section.

As regards the course of the affection, it is important to recognize that it does not carry a serious prognosis. It may last from two weeks up to seven or eight months and some fine pigmentary disturbances may be left. A point of some significance is the tendency to recurrences. The lesion is not always strictly central. It is practically always unilateral.

The ætiology is not fully established. In Japan it is believed to be of tuberculous origin. The possibility of it being due to photo-ophthalmia has also been discussed. This would link it up in some ways with the œdema of commotio-retina.

Dr. Weintraub tells me that the condition is well recognized in Vienna, where it is known as pre-retinal œdema. In conformity with English nomenclature it might be better named subhyaloid œdema.

There are on record two cases with tuberculous iridocyclitis. This is of significance not only from the ætiological aspect, but in the possible linking up with the macular detachment seen in some cases of cyclitis.

Discussion.—Mr. HAROLD RIDLEY said that he thought these cases were relatively common. He had collected the names of some 15 who had attended Moorfields in the last two and a half years. He had regarded them as due to a low-grade choroido-retinitis.

Mr. C. D. SHAPLAND said that he had seen three such cases during the last four years, all of them associated with sepsis in the mouth. One very striking case cleared up with the removal of a diseased tooth, the relative central scotoma enlarging very materially immediately after the dental extraction (two days), and then gradually diminishing until it reached a minimal size in some four to five weeks.

Contact Lenses Fitted to Patients at the Moorfields Contact-Lens Clinic.—T. J. PHILLIPS, L.R.C.P., M.R.C.S.

The first is a case of pemphigus. A new upper and lower fornix have been made by inserting a mucous membrane graft after freeing the eyelids from the globe. This was done by Mr. Maurice Whiting and, as can be seen, there is now quite a deep fornix below and the upper lid is free enough to allow considerable movement of the eye. When this patient was first seen the cornea was opaque and very similar to the other eye. A contact lens was made and the patient wears this practically continuously, using paroleine in the glass instead of saline. As can be seen the cornea is beginning to clear, and the patient admits that although she only sees shadows, she sees better than she used to do.

The next case, also a patient of Mr. Whiting, is a man of about 60 who has no useful vision in the right eye, which had a long-standing detachment and a complicated cataract. The left eye sees only $\frac{6}{18}$ partly with the best correction, the cornea being scarred by old nebulæ. He also has a spastic entropion. He was fitted with a contact lens which improved his vision to $\frac{6}{9}$, and of course the glass protects the cornea from damage by the lashes of his in-turning lower lid. He can wear the lens for fourteen hours a day and has done so since being fitted in January 1938.

The next two cases were both sent to me by Mr. C. D. Shapland from University College Hospital. They are both cases of high myopia. The first case R.V. with Sp. $-18{\cdot}0 = \frac{6}{24}$. L.V. with Sp. $-20{\cdot}0 = \frac{6}{36}$. She was fitted with contact lenses in June 1937 and with the lens R.V. $= \frac{6}{12}$ partly. L.V. $\frac{6}{12}$ partly. (Binoc. $\frac{6}{9}$.) She wears the lenses all day except for a few moments midday.

The second case, also a case of high myopia: R.V. with $-16{\cdot}0 = \frac{6}{24}$. L.V. with $-16{\cdot}0 = \frac{6}{24}$. R.V. with contact lens $\frac{6}{18}$. L.V. with contact lens $\frac{6}{18}$. (Binoc. with contact lenses $\frac{6}{9}$ partly.) This patient is able to wear her contact lenses the whole day. Both these cases have advanced myopic choroidal changes. The second of these two cases is also of interest as she has a small healed perforating wound at the limbus with a small peripheral iridectomy. There is no history of operation or injury.

The next three cases are cases of mustard-gas keratitis. No. 1 was gassed in 1918 and had no trouble until about 1937. Since then has had recurrent ulceration and gradual loss of vision. Treated at Moorfields under the care of Mr. Charles Goulden with atropine and pad and bandage. In January 1938 fitted with contact lenses. He has had no recurrence of his ulceration since being fitted. Mr. Goulden removed a calcified plaque from his left cornea and this was treated afterwards by putting the contact lens in the eye filled with paroleine. R.V. $\frac{6}{36}$. L.V. $\frac{6}{60}$. R.V. with contact lens $\frac{6}{18}$. L.V. with contact lens $\frac{6}{24}$. The patient wears the lenses all day.

No. 2 was gassed in 1918 and had no trouble from 1920–33. Since then he has had recurrent ulceration. Has been treated at Moorfields under the care of Mr. Affleck Greeves with atropine pad and bandage. Local ultra-violet light diathermy and X-rays. For months he had his left eye closed by tarsorrhaphy. R.V. $\frac{6}{60}$. L.V. $\frac{1}{60}$. R.V. with contact lens $\frac{6}{18}$. L.V. with contact lens $\frac{6}{60}$. He has had no recurrence of his ulceration. He wears the lenses all day—since June 1938.

No. 3 is not a typical case of gas keratitis. He was gassed in 1917. He commenced having ulceration as early as 1926. This is unusually early for ulceration to commence. Treated at Moorfields under the care of Mr. E. Juler with atropine pad and bandage. His R.V. = $\frac{6}{36}$, L.V. $\frac{6}{18}$. R.V. with contact lens $\frac{6}{24}$. L.V. with contact lens $\frac{6}{9}$. He has had one small recurrence since being fitted with contact lenses in January 1938 and wears the lenses all day except for one hour at midday.

The last case is a case of conical corneæ from Mr. Charles Goulden's clinic. This case is interesting because she was once fitted with Zeiss glasses and wore them for a time but they became progressively more painful and she had to give them up. She was fitted with contact lenses and after some trouble in wearing them when sitting before a fire now wears them all day. R.V. $\frac{6}{60}$. L.V. < $\frac{6}{60}$. R.V. with contact lens $\frac{6}{9}$. L.V. with contact lens $\frac{6}{9}$.

Discussion.—Mr. C. B. GOULDEN said Case 1 was very badly gassed; he had bad chest symptoms as well. It was of considerable interest why these cases did not occur until some years after the gassing. For a long time they were not pensioned, but that had now been rectified by the pension authorities, and the cases were recognized for this purpose without any further demur and compensation was paid. He had seen cases of mustard-gas keratitis dating longer back than 1930.

Mr. R. BICKERTON said that he had seen a considerable number of gas keratitis cases. Those shown that evening were relatively mild, thanks to the wearing of contact lenses, which was a perfect revelation to the possessor of the eyes and also to everybody else. It was perfectly true that most of these mustard-gas cases began to show eye symptoms seventeen or eighteen years after the gassing, but this was not always the case. It depended on the time they were in the gas cloud. He stated that the particular man whose job it was to let his comrades behind him know when a gas attack was approaching (gas guard) could not wear a gas mask himself until he had given the alarm, which he did on a gong, and then he put on his gas mask, but the damage by that time had been done. A large number of these cases did not go on in the same amenable way as the cases described by Mr. Phillips. They developed a very deep-seated ulceration, and the cornea usually came to a point, gave way, and closed up again, the same thing happening on several occasions. It was not possible to put contact glasses on these cases or give them relief in that way. Mr. Treacher Collins many years ago used to employ a solution of mucin for xerophthalmia and he (the speaker) had tried that in several of these cases, but it did not help except in the case of one man some three years ago, who for a time obtained relief from it. His own theory was that mustard gas destroyed the mucin-secreting glands in the conjunctiva, and if the substance was replaced a certain amount of comfort was given. He did not believe in stitching the lids up in these acute cases because the cornea exfoliated inside the stitched-up lid. The only relief he had found was in homatropine and holocaine or cocaine in castor oil used as drops.

Mr. LINDSAY REA, in discussing the effects of gas burns on the eye, remarked that during a heavy gas attack that took place in the village of Villers-Bretonneux there were 1,000 Australians gassed. He took in the first 200 of these cases, and in not one of them had the eyes been washed

out immediately nor ointment applied. Many Germans were caught in their own gas, and he quite distinctly remembered how they came in, each with his hands on the shoulders of the man in front of him. Now, looking back, he realized how much suffering these men might have been saved if directions had been given regarding the washing out of their eyes and filling them up immediately with soft boric ointment.

If gas is to be used over a city like London better precautions will have to be taken regarding the treatment of one and all. The A.R.P. authorities should see to it that affected eyes are at once washed out in a correct manner and that ointment should be instilled.

Two Cases of Exophthalmic Ophthalmoplegia. — HAROLD RIDLEY, F.R.C.S.

I.—F. C., female, aged 34.

Left ptosis eight months. Diplopia three months, most marked on abduction and elevation of left eye. Attack of streptococcal pharyngitis preceded the onset of diplopia.

Investigated at Hounslow Hospital, where she worked. Cerebrospinal fluid normal. Lange colloidal gold test negative. Wassermann reaction negative in blood and cerebrospinal fluid. Skiagram of skull showed general thickening of the calvarium.

Now suffers from definite thyrotoxicosis; rapid, irregular pulse; tremor, retraction of right lid; slight proptosis. Also affected with musicogenic epilepsy, being especially sensitive to organ music and certain works by Tchaikowsky. After a stimulus of fifteen seconds a true fit occurs, followed by extensor plantar responses and other physical signs.

II.—G. G., female, aged 44.

16.2.37: Vision $\frac{6}{5}$ in each eye. Weakness of right superior rectus. Thyroid had been removed some years previously. Right superior rectus palsy gradually increased until all upward movement of the eye was lost.

Now shows paresis of right superior rectus and right inferior oblique. Lid retraction and slight proptosis present.

This condition was well summarized by Dr. Russell Brain[1] in 1937. It may occur with thyrotoxicosis or after thyroidectomy. Movements of the eye, usually elevation, are affected rather than individual muscles. Unlike Graves' disease 80% of cases occur above the age of 40, and the proportion of females to males is 3 to 2. The cause is thought to be the pituitary thyrotropic hormone, which in dogs has a greater action when the thyroid has been removed. It differs from myasthenia gravis in that prostigmin has no effect. Microscopical section shows œdema, lymphocytosis, and later fibrosis of the muscles.

[1] RUSSELL BRAIN (1937), *Tr. Ophth. Soc. U. Kingdom*, **57**, 107.

? Dimner's Lattice Keratitis.—HAROLD RIDLEY, F.R.C.S.

E. H., male, aged 44.

Gradually increasing mist over eyes for ten years. Vision, R. and L. $\frac{6}{36}$. Irregular linear opacities in substantia propria, most marked below Bowman's membrane. No vascularization. Centre of cornea relatively little affected. No familial history.

Capsular Synechia to a Vascularized Line on Posterior Corneal Surface —F. A. JULER, F.R.C.S.

M. P., female, aged 66.

14.4.38: Extraction, with irrigation of anterior chamber.

15.4.38: Abscission of iris prolapse.

The line of adhesion runs from the site of the section towards the centre of the cornea: the eye remains somewhat irritable, but the tension is normal and there is no K.P.

Retinitis Pigmentosa and Coats's Disease.—Frank Law, F.R.C.S.

C. J., female, aged 13.

History.—In March 1934 complained of difficulty of seeing in the dark. Father blind from retinitis pigmentosa.

R.V. $\frac{6}{18}$. L.V. $\frac{6}{6}$.

On examination.—Fundus shows fine retinal pigment disturbance, massive exudate, and vascular disease consisting of dilatations and bunches of fine vessels over exudate. Wassermann reaction negative.

Three Cases Fitted with Contact Lenses.—Ida Mann, F.R.C.S.

These cases were fitted with the help of Dr. Dallos when I was starting work with this type of glass about eighteen months ago. They all show extremely good tolerance, which is being maintained, an important point, as tolerance with Zeiss glasses may be good at first but is not often lasting. The first is a man aged 35, an electrical engineer, doing his full work, and wearing contact glasses fourteen to sixteen hours every day, whereas previously he was in danger of losing his job because his visual acuity was down to $\frac{6}{36}$ in each eye. He is a high myope (−24 approx.), with a good deal of choroidal atrophy, but with contact glasses he is now $\frac{6}{5}$ in each eye. He has worn his lenses now for about a year every day and all day, and I think he is one of the most satisfactory cases I have ever had from the point of view of tolerance and improvement in visual acuity and judgment of distance.

Another case is an old lady who is interesting from several points of view. She had senile cataract, much more advanced in one eye than in the other. I extracted one lens and she got very severe iritis soon after the operation. This proved to be due to avitaminosis. She had been living on a peculiar diet of boiled bones and tea without milk for three years. Her finger nails peeled off, and she got this iritis which cleared up directly she consented to a normal diet. She afterwards complained of intolerable diplopia whether she was wearing a correction or not. When she used the eye from which the cataract had been extracted she could not get rid of the image from the other eye which still saw $\frac{6}{18}$. I gave her a contact lens for the operated eye and she now has binocular vision and a perfectly good judgment of distance. She also wears the lens all day.

The third contact glass case is simply a protective one in a patient who has had pemphigus. Both conjunctivæ contracted completely and adhered to the globes, and Mr. Whiting did a plastic operation on the lids of the better eye to enable her to keep her contact lens in. She wears it simply to prevent the drying up of her cornea. With a contact lens she can count fingers at 2 or 3 ft. ; without it she is down to a bare perception of light.

Diagnosis of Coats's Disease (? Lindau's Disease).—Ida Mann, F.R.C.S.

J. B., male, aged 18.

History.—November 1936 complained of mistiness of right eye for four months.

On examination.—Large white glistening patch at the macula. Varicosities and dilatations of retinal vessels.

Skiagram of the skull showed no bony abnormality.

True Ocular Torticollis and Retinal Angiomatosis.—Ida Mann, F.R.C.S.

M. S., female, aged 10 years.

History.—Left eye always queer.

On examination.—Nystagmus lateral and slight rotary. Heterochromia. Left microphthalmos with complete coloboma of the choroid ; complete inferior coloboma of iris.

Holds head tilted to left. Probably true ocular torticollis.

Right fundus shows some angiomatosis at disc. R.V. $\frac{6}{9}$.

Wearing glasses R. + 3·00, L. opaque disc. With glasses holds head much straighter.

This case is one of multiple anomalies. One would imagine that she had practically no sight at all in the microphthalmic eye, but she has always made some attempt to obtain binocular vision, and has even developed an ocular torticollis in order to compensate for the image she sees with the eye which has coloboma. It is difficult to see why she should be worried by it at all, but she is much happier when it is occluded.

Right Retinal Detachment: ? Inflammatory, ? Secondary Neoplasm.—H. G. Skeoch, F.R.C.S. (Shown by permission of Mr. H. J. Taggart, F.R.C.S.)

L. R., male, aged 58.

Previous history.—Right kidney removed for hæmaturia five years ago. Pathological report: Capillary adenocarcinoma (hypernephroma).

Now complaining of R.V. failing lately.

R.V. $\frac{6}{60}$; L.V. $\frac{6}{9}$ with correction.

Right retinal detachment inferior nasal quadrant, ? inflammatory, ? secondary neoplasm.

Case for Diagnosis.—P. G. Doyne, F.R.C.S.

S. V., female, aged 43.

History.—In January 1934 R.V. $\frac{6}{6}$; L.V. $\frac{6}{9}$.

In November 1938 complained of pain in left eye. R.V. $\frac{6}{12}$; L.V. $\frac{6}{18}$.

On examination.—Both fundi rather pale and veins somewhat dilated. Left disc was swollen, arterial pulsation. Left tension +. Fields normal.

Examination by the physician failed to show any signs of general disease.

Paget's Disease associated with Transverse Band Degeneration of both Corneæ.—E. E. Cass, M.B., B.S.

S. M., male, aged 74.

24.11.38: Came to Moorfields complaining of a floater in his left eye and diminishing visual acuity. The large size of his head was noted and he stated that during the last ten years he had been taking a gradually increasing size in hats (i.e. from $6\frac{7}{8}$–$7\frac{1}{2}$). He also had gradually become deaf. A diagnosis of Paget's disease was made.

On examination.—R.V. $\frac{6}{9}$ p. with sph. + 1·25 = $\frac{6}{9}$; L.V. $\frac{6}{12}$ with $\frac{+1{\cdot}0}{+0{\cdot}5 \rightarrow 120} = \frac{6}{9}$.

Corneal.—Naked eye and with the loupe a subepithelial degenerative change could be seen in the left cornea. This change lay in the palpebral aperture, and had sharply defined upper and lower margin.

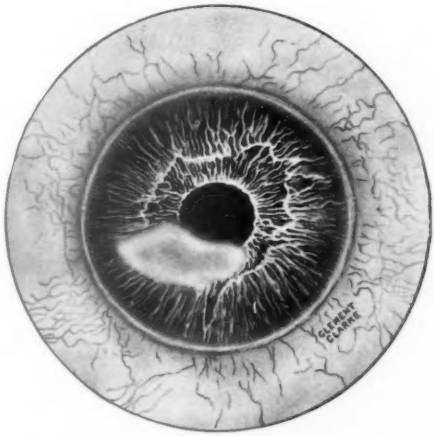
On examination with a slit lamp this degenerative change was seen to extend from just internal to the limbus on the nasal side in the form of a band stretching across the cornea. The change was punctiform in the centre, but coalesced on the nasal and temporal sides and lay chiefly in Bowman's membrane; however, it extended at some places into the substantia propria. There were one or two small vacuoles in the band on the nasal side. On examination of the right eye, although nothing could be seen with the naked eye or loupe, a similar less advanced change was found to be taking place.

Left vitreous showed a few opacities. Both discs showed senile cupping.

Physician's report: Confirmed the diagnosis of Paget's disease and stated that there was marked bowing and thickening of the left tibia, and that this condition commenced forty-eight years ago.

X-ray report: Paget's disease of the skull and tibiæ, also left fibula. Lower lumbar vertebræ and pelvis also involved.

Only two cases of band degeneration of the cornea occurring in Paget's disease have been previously reported. The first case was described by Peppmüller in 1937, and he had watched its progress for seven years. In this case symmetrical bands were present in both corneæ and spread across the corneæ from both limbi. In the course of time they became pigmented and also melanin deposits occurred in the



Naked-eye view of left cornea. With slit lamp, band is seen to extend across cornea ending just internal to the limbus.

conjunctiva of both eyes. The patient had arteriosclerosis as well as Paget's disease. The author queried whether there was some connexion between the pathology of these bands and Paget's disease.

The second case was found by Von der Heydt (also in 1937), when he examined a case of Paget's disease with the slit lamp. The bands were very similar but in this case had commenced in the centre of the corneæ and spread outwards.

Of the pathology of Paget's disease little is known, but it is generally thought to be connected with a disturbance of calcium metabolism.

There are three types of band keratitis:—

(1) In eyes which have had a long-standing chronic disease.

(2) In healthy eyes, which are subjected to some frequent irritation, such as foreign bodies, dust, &c., during work.

(3) In healthy eyes, but after the patient has suffered from a recent illness.

The question to be decided is as to whether there is some connexion between the pathology of these bands and the pathology of Paget's disease.

I would like to thank Mr. Juler for his permission to show this case.

References.—PEPPMÜLLER, F., (1937), *Klin. Mcnatsbl. f. Augenh.*, **98**, 1. VON DER HEYDT (1937), *Am. J. Ophth.*, **20**, 1139.

Unilateral Papillitis of Obscure Ætiology.—C. Dee Shapland, F.R.C.S.

Rosemary S., aged 19.

First seen on 20.6.38, with a history of progressive failure of vision in the right eye for the previous three months.

On examination.—R.V. $\frac{6}{36}$, not improved. Right disc hyperæmic and surrounded on all sides by a fairly well-defined greyish-white ring. Veins somewhat congested; arteries normal. L.V. $\frac{6}{5}$ with $\frac{+2{\cdot}25}{+0{\cdot}5}$ ax. 90°; fundus normal.

Provisional diagnosis: Right papillitis—disseminated sclerosis. The right visual acuity failed to improve and patient was admitted on 31.8.38, for further investigation.

Wassermann reaction negative; Mantoux weak positive; no intranasal source of sepsis. Central nervous system: Indefinite right hemi-hypalgesia extending over the whole of the body, but appearing to cross the mid-line everywhere by 1 to 2 in., and therefore suspected of being hysterical. Reflexes relatively diminished in the left lower and in the right upper limbs. Abdominals just present.

No other physical signs.

28.11.38: Vision right = fingers at 2 ft.; no cells in anterior chamber; some pigment scattering in the vitreous; whitish area relatively greater on temporal side of disc; ocular movements full; no proptosis; concentric contraction of both fields; right central scotoma.

Exudative Retinitis: ? Nature.—Maurice Whiting, F.R.C.S.

J. R., female, aged 14.

Case first seen by Mr. C. Dee Shapland, at school clinic. R.V. was found defective at a routine school test.

On examination.—Right exudative retinitis. Wassermann and Mantoux reactions negative.

The fundus picture has changed since 1936 and now shows massive exudates at and around the macula, with tortuosity and irregular dilatations of the vessels.

Mr. C. Dee Shapland: This was a child whom I first saw in a school clinic. She then had $\frac{6}{36}$ vision in the right eye, not improved, and the fundus showed an exudative retinitis. In 1936 there were small varicosities on some of the retinal veins. The case has progressed like Coats's disease, Type 3, namely that associated with gross vascular anomalies. There is now very much more exudate in the infero-nasal quadrant, and there are aneurismal dilatations on the retinal veins.

An Unusual Type of Corneal Dystrophy.—C. Dee Shapland, F.R.C.S.

Florence Q., aged 48.

First seen on 29.9.38 with a history of misty vision for the previous six months. Had worn glasses since the age of 4 on account of a convergent squint in the left eye. R.V. $\frac{6}{24}$ with glasses $\frac{+4{\cdot}75 \text{ sph.}}{+1{\cdot}50 \text{ ax. } 90°}$. L.V.: Counts fingers with + 4·25 sph.

Both corneæ show a beaten-silver appearance of the whole endothelium with a fine pigmentary dusting.

The cause of the poor visual acuity in the right eye was at first somewhat obscure. On ophthalmoscopic examination it was not possible to see the fundus in sharp detail, the reason for this and the defective vision was immediately revealed, however, by the slit lamp which showed a dystrophy of the whole endothelium. The posterior corneal surface of both eyes had an appearance resembling beaten silver. Mr. Goulden is of the opinion that this case represents the first stage of a Fuch's epithelial dystrophy.

Myopic Detachments of the Retina associated with Senile Cataract in Both Eyes.—C. DEE SHAPLAND, F.R.C.S.

Charlotte J., aged 75.

First seen at Blind Certification Clinic on 12.9.38.

History of left vision having gradually failed three years ago. R.V. increasingly misty last two years with sudden appearance of "black lump" seven days previously. Patient had worn glasses for twelve years, and believed that she had always been short-sighted.

On examination—

R.V.: Fingers at 6 in. } wearing $\frac{-5{\cdot}0}{-0{\cdot}75 \text{ ax. } 90°}$
L.V.: Hand movements } $-3{\cdot}75$ sph.

Right eye had an advanced senile cataract of the cuneiform variety, through which a balloon detachment of the retina could be dimly seen in the superotemporal quadrant. A large horse-shoe tear was just visible on the summit of the detachment.

Left eye had a total detachment of the retina of considerable chronicity.

17.9.38: Patient admitted to hospital. On 19.9.38 simple extraction of the right cataract. The detachment with its hole was now clearly visible, and a surface diathermy with one needle puncture was performed on 6.10.38. A moderate degree of iritis followed this operation, but responded to local treatment. Capsulotomy was done on 27.10.38, and on 10.11.38 the right retina was seen to be in situ and the visual acuity with $\frac{+9{\cdot}0}{+2{\cdot}0 \text{ ax. } 180°} = \frac{6}{6\,0}$. Field full to 1° white object at $\frac{1}{3}$ m.

Leber's Disease in Twins.—E. F. KING, F.R.C.S.

I.—Ethel M., aged 20.

First seen 27.4.38 complaining of visual failure and headaches for six months.

On examination.—R.V. $\frac{1}{6\,0}$ } not improved.
L.V. $\frac{6}{3\,6}$ }

Pupillary reactions and tension normal. The fundus vessels were seen to be unduly tortuous, but this was not considered of pathological significance. The right optic disc showed slight temporal pallor; the left optic disc was normal. The peripheral fields were full, as they have been at all subsequent examinations.

The central fields showed, in the right eye a large scotoma, involving and extending upwards from fixation, and in the left eye a much smaller scotoma down and out and just missing fixation.

The diagnosis was thought to be either pituitary tumour or Leber's disease, probably the former as the patient was a female and the family history at the time was negative.

On May 14, 1928, Sir Adolphe Abrahams admitted the patient to Westminster Hospital where all general and special investigations proved negative. While still an in-patient there the general practitioner sent the girl's twin brother to Moorfields as he, too, was thought to have "eye trouble".

II.—Percy M., aged 20, twin brother of Case I.

R.V. $= \frac{6}{6}$; L.V. = finger-counting at 2 ft., not improved.

Pupillary reactions and tension normal. As in the sister, unusual tortuosity of the fundus vessels was seen. Right optic disc normal; left optic disc showed temporal pallor. Peripheral fields full. Right central field normal. In the left central field was a very large scotoma involving and extending upwards from fixation (*see* charts).

This boy was also admitted to Westminster Hospital under Sir Adolphe Abrahams, and, as with his sister, all investigations were negative.

With the appreciation of the familial nature of the affection the diagnosis of Leber's disease was made with confidence. Apart from the two patients there is no history of defective vision in the family.

Subsequent examinations have shown enlargement of the scotomata and deterioration of central vision in both patients. The boy's right eye, which was normal when first examined, showed a scotoma involving fixation in September. There is now temporal pallor of both optic discs in both patients.

Unusual Type of Detached Retina.—F. A. JULER, F.R.C.S. (shown by A. G. CROSS, F.R.C.S.

D. D., female, aged 31.

The left eye has always had bad vision, but became worse a fortnight ago. When she came up to hospital she was found to have, in the right eye, a faint corneal nebula, one or two spots of old K.P., and the right vision was $\frac{6}{6}$ with + 0·5 D. sph. and — 0·75 D. cyl., axis 180°. In the left eye there was a well-marked corneal nebula, with a balloon detachment of the retina above. The left vision was less than $\frac{6}{60}$.

When first seen, a hole was suspected on the balloon at about 2 o'clock. She has been kept in hospital, and now a large hole is seen at 6 o'clock far back from the periphery. The interest of this case lies in: (1) The relation of the balloon detachment above and the large hole below. (2) The marked eversion of the retina at the edges of the hole.

Discussion.—Mr. COLE MARSHALL said that he had a case of a girl aged 18 with double detachment. As far as he remembered the left retina was detached about four years ago; the right was comparatively recent. There were no definite holes to be seen, but large areas of degeneration were visible. He operated on the worst side first and got the retina back and, much to his surprise, in spite of some degeneration of the macula, she had a vision of about $\frac{6}{18}$. Then he operated on the right eye, doing a large barrage. There seemed a large amount of degeneration of the retina in the lower third of the fundus, and that was why he carried out this procedure. The vision was $\frac{6}{9}$ in the right eye after the operation, but she got an extraordinary condition peripheral to the barrage he had made—a very woolly appearance which apparently persisted and the like of which he had not seen before. She still had her sight, and vision of $\frac{6}{9}$ some months after the operation, notwithstanding this unusual condition.

Mr. J. P. F. LLOYD said that he could quote a very similar case in a patient aged 50 years whom he first saw about two and a half years ago when she had an exudative detachment very like the one shown. It was so obviously exudative that he left it, and eventually it gradually went back almost completely except at the periphery. Unfortunately a very large area of the retina was destroyed by atrophy. Eight or nine months later she commenced to develop a cataract in the other eye, which gradually became mature. He removed the cataract and the sight, notwithstanding operative complications, came up to $\frac{6}{9}$ or $\frac{6}{12}$, and the fundus was completely normal. Several months later a condition of exudative detachment started in this eye below. He repeated every investigation and, as all were negative, gave her a short course of prontosil. He thought the prognosis of operation for these detachments would be very poor indeed.

Cyst of Right Retina.—HUMPHREY NEAME, F.R.C.S.

H. B., female, aged 17.

History.—Vision of right eye had been noticed to fail for six months. Previously quite good. The left eye had always had defective vision and had squinted from birth. No visit to the tropics at any time. Born in Ireland.

On admission (7.9.38).—R.V. $\frac{1}{60}$; no improvement with + 1·25/+ 0·25, axis 90°. L.V. $\frac{1}{60}$ no improvement with + 2·0/+1·0 D. cyl. Condition of fundus oculi: Adjacent to the right optic disc a cystic swelling extended down and out from the inferior temporal margin. It was some 3-disc diameters in length and

less in breadth, the long axis being directed down and out. To the temporal side of the swelling, which had transparent walls, was a small amount of white exudate. A small spot of pigment was visible through the anterior wall of the cyst lying on its posterior wall. Delicate tension lines in the retina visible, especially below. The left eye was of normal appearance in all respects. Wassermann reaction negative.

The right field of vision with 0·5° white object (28.9.38) was of normal shape extending out to between 40° and 50° above, below, and to nasal side, and to 80° temporal side. A scotoma present to a white object above extended to within 1° of the fixation point (5/2,000 on Bjerrum's screen).

Examination of the blood at the Hospital for Tropical Diseases failed to reveal any evidence suggestive of the presence of a hydatid cyst. (Complement-fixation test, Casoni skin test, blood-count.)

16.11.38: Tension lines in the retina of the right eye are more noticeable, particularly above the cyst. The walls of the cyst are less transparent and more exudate is present around it. The pigment spot still visible in the posterior wall is probably a little larger and a small separate dot is visible.

Myasthenia Gravis.—S. P. MEADOWS, M.D.

W. H. S., male, aged 68.

History.—August 1938, sudden onset of diplopia and squint, followed soon afterwards by bilateral ptosis and weakness of right arm and right leg. More recently, left arm and left leg have become weak. No dysphagia or dysarthria.

On examination.—Bilateral ptosis, increased by attempt to look upwards for a short period. Ocular movements variable, but impaired in all directions, especially marked in left eye. Pupils normal. Weakness of orbicularis oculi on both sides. No weakness of tongue, palate, or jaw muscles. Weakness of all four limbs. Reflexes normal except ankle-jerks—not elicited. Sensation normal.

Injection of prostigmin 2·5 mgm. and gr. $\frac{1}{100}$ atropine produces almost complete disappearance of ptosis, ocular palsy, and weakness of limbs.

This case developed progressive ptosis and diplopia. One important point in the diagnosis was the weakness of the orbicularis oculi. This is almost always weak in cases of myasthenia with ocular paralysis. Secondly, the ptosis was increased when the patient attempted to look upwards for a minute. The third point was his reaction to prostigmin, after an injection of which the ptosis disappeared, and ocular movements returned almost to normal. With a full dose of prostigmin, $2\frac{1}{2}$ mgm., the effect lasts four or five hours, and then the diplopia and ptosis return. Prostigmin sometimes produces generalized symptoms which may be prevented by the simultaneous administration of $\frac{1}{100}$ gr. atropine.

Two Cases of Familial Keratitis.—J. H. DOGGART, F.R.C.S.

I.—W. E. G., male, aged 48.

History.—Sight has been bad since boyhood. About thirty years ago he was advised to undergo scraping of each cornea.

Family history.—His mother and his mother's father are said to have had similar trouble. His daughter also is affected.

On examination.—Vision, with glasses, is $\frac{6}{18}$ mostly, R. and L. Fundi normal, so far as can be ascertained. Both corneæ show clear zones at the periphery, but in the central portion there are numerous opacities occupying all layers of the substantia propria. Some of the opacities are round, but most of them are irregular in shape, resembling bone sequestra or pieces of coral. Endothelium healthy. No disturbance of corneal sensation.

II.—Miss M. G., aged 20.

Vision : $\frac{6}{12}$ R. and L. Fundi normal, so far as can be ascertained.

Both corneæ show clear zones at the periphery, but in the central portion there are numerous opacities occupying all layers of the substantia propria. Some of the opacities are irregular in shape, but many of them are disciform. Endothelium healthy. No disturbance of corneal sensation.

The following cases were also shown :—

By Harold Ridley, F.R.C.S.

Two Brothers Suffering from Familial Macular Degeneration.

By Maurice Whiting, F.R.C.S.

Persistent Hyaloid Vessels.

By Hugh Skeoch, F.R.C.S.

(1) **Persistent Hyaloid Vessels.**

(2) **Left Persistent Hyaloid Vessels.**

(3) **Retinitis Pigmentosa.**

By C. Dee Shapland, F.R.C.S.

(1) **Unilateral Central Retinal-Choroiditis in a Young Subject.**

(2) **Bilateral Neuro-retinitis in a Child.**

By E. F. King, F.R.C.S., and Swithin P. Meadows, M.D.

Pituitary Tumour.

By A. G. Cross, F.R.C.S. (for Humphrey Neame, F.R.C.S.).

Bilateral Retinal Detachment.

By Humphrey Neame, F.R.C.S.

Rupture of Choroid in Upper Part.

By Swithin P. Meadows, M.D.

Pituitary Adenoma.

By Eugene Wolff, F.R.C.S.

Case Showing the Normal Network Formed by the Hexagonal Pigment Epithelium of the Retina.

Section of Obstetrics and Gynæcology

President—Aleck W. Bourne, F.R.C.S.

[*February* 17, 1939]

Radium Treatment of Menopausal Hæmorrhage Followed by Carcinoma of the Body of the Uterus Three Years Later

By S. Gordon Luker, F.C.O.G.

The treatment of benign uterine bleeding associated with the menopause by an intra-uterine application of radium is recognized as an eminently satisfactory procedure. It is an example of conservative gynæcology, by which many women have been spared a radical operation for removal of the uterus. Provided that there is no organic disease or tumour in the uterus or endometrium, cure is effected in a very large proportion of cases. It has not been decided whether the action of the radium is on the uterus or ovaries or both—the latter is probably correct. There is certainly some action on the uterus.

The question arises whether carcinoma of the body of the uterus ever follows this treatment and if so, whether it is in any way a remote effect of the application of the radium. Until recently I had not seen a case and had formed the opinion that there was no risk of such a sequela. This opinion has now been challenged by a case of which the history is as follows :—

The patient, a widow aged 51, who had had one child twenty years previously, was seen by me first three years ago, suffering from uterine hæmorrhage. Her history was that the periods had been regular until about eighteen months previously. Then the periods began getting less frequent, and during the previous winter she had had amenorrhœa for six months. In April 1935 she went to America and had amenorrhœa until August. The next period occurred in October about the time of her arrival in England on October 6. This period did not stop and she saw something every day till five weeks later when she had another period. There was no pain and no other symptoms. On examination the cervix appeared normal and the uterus slightly enlarged. Exploratory curettage was performed on November 18. The uterine sound passed 3½ in. Curettage showed no histological evidence of disease and 50 mgm. of radium element were inserted into the uterine cavity for thirty-six hours. Bleeding ceased for three years and recurred on November 18, 1938, when the uterus was felt to be definitely enlarged, and immediate hysterectomy was advised. On examination after removal the uterine wall was thickened and the uterine cavity was enlarged.

Histologically there was wide and deep invasion of the uterine wall by an irregular growth of columnar-celled carcinoma.

This is the only case in my own experience where carcinoma corporis has occurred after previous radium treatment. In looking through the literature, however, the following references to this subject have been found :—

In a series of 200 cases treated in Liverpool, Malpas [1] reports one case of corporeal carcinoma occurring twenty months after radium application.

Martindale reports one case in which carcinoma was found one year after radium treatment. Bland records one case in which carcinoma was found three years after radium treatment. Schintz reports two cases occurring one and three years respectively after radium treatment for fibroids. Naujoks reports one case of his own occurring three years after radium treatment and quotes three other cases. Leda Stacey records two cases, one occurring after a dose of 600 mgm. hours and one which was found two and a half years after radium treatment of 500 mgm. hours for fibroids. Essen Moller says he had six cases of corporeal carcinoma after radium castration and has accordingly abandoned the method. He considers the carcinoma may have been consequential upon the treatment and that this danger is very real.

The points which arise for discussion are whether, in the reported cases, the carcinoma was already present at the time of radium treatment or whether it was a result of the treatment. The rarity of this occurrence seems to make it improbable that the new growth was the result of the previous radium treatment. It seems more likely that carcinoma would have occurred in any case or that carcinoma was present when curetting was performed and that the curetting and microscopic examination failed to detect the new growth. In my own case, the length of time—three years—which elapsed between the radium treatment and the subsequent carcinoma, makes me incline to the opinion that the onset of carcinoma was in no way consequential upon the previous treatment with radium.

Discussion.—Mr. L. C. Rivett did not think it likely that the irradiation could have caused the carcinoma, as X-ray or radium carcinoma occurs only after prolonged exposure.

Carcinoma of the body is very slow growing and after irradiation may remain symptomless for a long time—even years. He thought it was probable that the carcinoma had been present in this case all the time. He himself had not seen a case of carcinoma following irradiation for menopausal hæmorrhage.

Mr. Victor Lack said that at Mr. Luker's request he had looked up the records of the London Hospital. In about 1,000 cases of menorrhagia treated by radium two or more years ago no case of carcinoma of the endometrium had been reported.

He had seen recognized cases of carcinoma of the body remain quiescent for more than two years after treatment with a single dose of 100 mgm. of radium for twenty-four hours.

Mr. T. F. Todd said that he was very interested in the problem raised by Mr. Luker. He had had one personal case three years ago, and on looking up the literature then he had been surprised to find the condition was by no means rare, as over 70 cases had been reported. He thought it was very difficult to decide the relationship between the radiation and the subsequent malignancy. In a paper on the complications of radiotherapy for menopausal menorrhagia published a few months ago he had pointed out that in three cases he had performed hysterectomy for recurrent hæmorrhage some months after radiation sterilization ; in these cases curettage failed to produce anything, but he had proceeded to hysterectomy because the diagnosis was uncertain. Inspection of the uterine cavity showed no recognizable endometrium, but a very thinned-out membrane with numerous telangiectatic patches—evidently the hæmorrhage had come from a small ruptured varix, as was known to happen elsewhere (in the bladder, for instance). In such cases it was very difficult to see how carcinoma could arise from such an atrophic endometrium, but in all of them it was known that too high a dosage of radium had been employed. Presumably with the lesser therapeutic dose more commonly utilized such atrophic changes would not occur and malignancy might develop subsequently. He thought that the pathologists' view was that most such cases represented the gradual development of a malignant growth that had actually been present at

the time of radiation, but which had been overlooked at the original curettage—this would seem to be most likely in those growths occurring within two or three years of radiation. The amount of radiation employed would not be sufficient to inhibit permanently malignancy already present, and if excessive dosage was employed he thought it unlikely that malignancy would occur anew in view of the degree of endometrial atrophy that was produced. Again the majority of the reported cases occurred within a few years of radiation, whereas those cases of malignancy arising in previously irradiated areas, as in the neck after irradiation of goitres, occurred many years, fifteen or twenty, after treatment, and also were usually associated with a beta ray effect.

Mr. Luker raised the old argument of whether the radium acted on the endometrium or the ovaries. Surely it was apparent that it would act upon both in every case. The endometrial effect with therapeutic doses should be a transient one, whereas with too high doses telangiectasia in an atrophic membrane, or actual necrosis was produced. He thought that with the usual therapeutic dosage the effect was produced through inhibition of ovulation—a similar effect could be equally easily produced by X-radiation of the ovaries when an endometrial factor could be absolutely excluded.

Mr. C. A. HORDER described a case now under his care of a woman aged 53 who had a course of X-ray treatment for a fibroid uterus at St. Bartholomew's Hospital three years ago. One year later her abdomen was opened for a pelvic swelling and an ovarian cyst was removed, pronounced by the pathologist to be an adenocarcinoma.

A year after this, investigation for persistent vaginal hæmorrhage revealed a carcinoma of the body of the uterus, necessitating a total hysterectomy.

Two Cases of Endometrioma of Ovary suggesting the Transplantation Theory of Origin.—JAMES WYATT, F.R.C.S.

Case I.—Patient, aged 46, complained of a lump in the left groin first noticed one year ago, which had increased in size in the last three months. Menstruation had

Case I.—Typical endometrial tissue on the wall of tumour of left ovary.

been irregular for the last three years, there being sometimes intervals of three months, but for the last five months it had been regular. She had one child aged

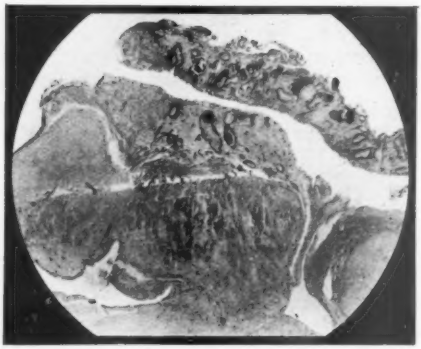
13 years. There had been some frequency of micturition, which was relieved by the insertion of a ring pessary two months previously. Examination of the abdomen disclosed no obvious tumour, but on vaginal examination the uterus was found to be somewhat enlarged and there was an irregular mass occupying the pouch of Douglas. Laparotomy was performed, and bilateral tarry cysts of ovary discovered adherent to surrounding structures. A subtotal hysterectomy with removal of both appendages was carried out. The convalescence was normal. Pathological examination of the tumour from the left ovary showed typical endometrial tissue, which appeared to have been implanted on the wall of the cyst.

Case II.—E. R., aged 41. Single.

Menstruation commenced at 14, was of the twenty-eight day type lasting five days, regular and accompanied by slight pain. For the last three years pain had been gradually increasing. General health good. For about six months had noticed a swelling in the left iliac fossa.

Examination showed a cystic swelling to the left of the mid-line about the size of a croquet ball.

Laparotomy was carried out. Bilateral tarry cysts were discovered ; that on the left side the size above described, and that on the right about the size of an orange.



Case II.—Section showing typical endometrial tissue.

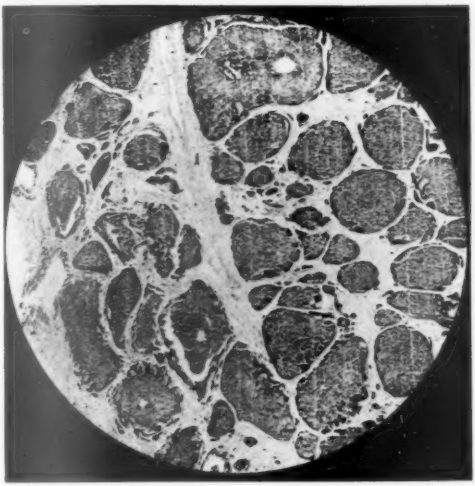
They were adherent to surrounding structures and both ruptured in separating the adhesions. Both appendages were removed. Convalescence was complicated by a mild attack of bronchitis, but she left hospital three weeks later quite well.

An examination of the left tumour showed that the inner walls were lined with a thin epithelium discoloured by old blood. In one situation was a small loculus the size of a hazelnut communicating with the main cyst, and this was lined with a thickened epithelium suggestive of that lining the uterus, and from this part a piece was removed for section.

Granulosa-celled Tumour of Ovary in a Child of 4 Years.—JAMES WYATT, F.R.C.S.

The patient was an only child of 4½, who had had measles and whooping-cough but was otherwise healthy. She was brought up to hospital by her mother as a blood-stained vaginal discharge had been noticed for one month.

On examination the child appeared healthy—3 ft. 6 in. tall. There was quite marked development of the breasts, some pubic hair, and the labia majora and minora were markedly developed for the age. Abdominal examination revealed a firm round mobile tumour the size of a tennis ball. Friedman's test was negative. X-ray showed



Section of granulosa-celled tumour.

a normal sella turcica. On 12.4.38 laparotomy was performed, and the tumour was found to be growing from the right ovary. Left ovary was normal. The uterus was the size of one of early puberty. The tumour was removed, and the convalescence was normal. A moderate loss of blood per vaginam occurred for four days following operation.

Follow-up.—General health good, one very slight loss of blood one month after operation, nil since. The breasts have retrogressed though still larger than normal.

The tumour, which was of an ovoid shape, was about 11 cm. long and 6 cm. in width ; on section it was of a pale biscuit colour and firm in consistency. A part of it and a section are in the collection of the Royal College of Obstetricians and Gynæcologists.

A Case of Pseudo-hermaphroditism.—JAMES WYATT, F.R.C.S.

This child, born in 1922, was at birth thought to be a girl, but at the age of 9 months was taken to an infant clinic where it was thought that it was a male child with hypospadias. It was consequently brought up as a boy. In February 1935 it was brought up to me at hospital dressed as a boy with the name of Samuel with the following history : At the age of 11½ there had been a discharge of blood lasting four days, and since that time there had been a loss every twenty-eight days lasting five

to six days. On examination one found a healthy child with well-developed breasts and pubic hair. The genital organ was larger than the normal clitoris, and more suggestive of the hypospadiac penis, and at its base was a small opening from which the urine and the menstrual blood escaped. Behind this the perineum was covered with skin with a median raphe and no suggestion of any labia. Lipiodol was injected through the opening and report stated it lay in two masses, that to the left joined to lower part by a narrow isthmus and that to the right a somewhat indeterminate mass. The picture did suggest the presence of a vagina.

In December 1936 I examined her under an anæsthetic. *Per rectum* a tubular mass lying well to the left of the mid-line was felt suggestive of a uterus. A large rubber catheter passed backwards under the perineal skin and then up to the mass felt in the pelvis. I felt it best to wait until the child was more mature before attempting any plastic operation.

In August 1938 she returned to hospital, and under pentothal and gas and oxygen, I operated. A No. 4 Hegar's dilator was passed through the opening present keeping

FIG. 1.—Before operation.

it just under the skin until its point was about half an inch anterior to the anus. At this point an incision was made large enough to admit the little finger which passed easily upwards into a smooth cavity at the top of which lay the cervix uteri. This incision was then carried forwards to the point of entry of the dilator, and the raw edges sutured over with catgut.

The noticeable point was the distance from the external urethral meatus to the genital gland, well over an inch, whereas the usual distance from the clitoris is about half an inch.

I cannot get any reference to this point from the anatomists, but its site does suggest more the situation of the penis. The disposition of pubic hair in this case

is suggestive also of male distribution ; if at a later date there is much growth of hair on the face I propose to open the abdomen and examine the genital glands, as to whether one is in the nature of an ovo-testis.

FIG. 2.

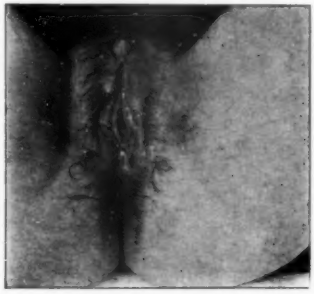


FIG. 3.

Six months after operation. Vaginal cavity easily admits a No. 14 Hegar's dilator.

Mr. GREEN-ARMYTAGE I was interested in the case of pseudo-hermaphroditism as I saw an almost identical case several years ago. I would like to suggest that Mr. Wyatt should now persuade the patient to return for laparotomy, for if this was done I think he would find as I had that there was either one or perhaps two tumours of the ovary. In my own reported case both ovaries were the size of dried walnuts with a hard dull white surface. Two-thirds of each was removed leaving a small portion near the hilum. On section the excised portions were reported by Sir Leonard Rogers to be of the structure of an ovo-testis. Apart from the scientific value of such action there was the therapeutic and cosmetic effect, for it will be found that not only the facial beard but the hypertrophied clitoris will disappear, factors of some moment in the sex life of the girl. In my case there was amenorrhœa for eleven months and then normal rhythm.

Report on a Case of Granulosa-cell Tumour in a Girl of 11 Years.—M. MOORE WHITE, F.R.C.S.

R. S., aged 11, was admitted to the Royal Free Hospital in March 1936 with a history of vaginal bleeding in association with an abdominal tumour. Two years before, at the age of 9, there had been a small vaginal hæmorrhage. One year later there was a second small loss, followed seven months later by hæmorrhages of the nature of a menstrual period at monthly intervals for five months until her admission. On two occasions the loss was severe with passage of clots.

Examination revealed a girl of average size and weight for her age. She was pale but looked otherwise healthy. Mentally she was not in advance of her age. The breasts were full and rounded, and axillary and pubic hair was present.

On abdominal examination a swelling was felt which was apparently bilobular. It rose out of the pelvis to the level of the umbilicus on the left, but fell short of this on the right. It was hard, smooth, dull on percussion and painless.

Per rectum a mass was felt, which filled the pelvis.

Abdominal section was performed on March 4, 1936, and the uterus found to be enlarged to the size of fourteen to sixteen weeks' pregnancy. It was displaced

upward and to the left by a tumour the size of a fœtal head occupying the right side of the pelvis. The left ovary was normal except for a small cystic follicle. The tumour was removed, it measured $5\frac{3}{4}$ by $4\frac{1}{2}$ by 4 in. and weighed 1 lb. $10\frac{1}{2}$ oz. It was encapsuled, smooth, and grey in colour.

Macroscopically it was homogeneous, of a creamish hue, and contained a few small cystic spaces.

Microscopically the structure was that of a granulosa-cell tumour of the folliculoid variety. A frozen section stained by scharlach-R showed a fair amount of lipoid both in the stroma and the cells.

Follow-up.—Over two years after operation the girl was in good health. For three months after operation she had no menstrual loss. Then monthly periods began which have continued regularly since. The uterus returned to its normal size. There is no evidence of a tumour of the remaining ovary.

Specimen of a Bilateral and Subcutaneous Leiomyoma of the Crura of the Corpora Cavernosa and of the Corpus Cavernosum from a Woman aged 27, with photographs and short film display.—LESLIE WILLIAMS, M.S.

The specimen which I show this evening is, I believe, unique.

The Index Medicus has been searched for the past ten years without any reference being found to a tumour of this nature. Professor Newcomb tells me that he can find a trace of only one similar tumour ever having been reported and that was in the case of a male.[1] That patient had two small myomata in the penile part of the corpus cavernosum. These two nodules were separate, one being on the dorsum and one near the frenum of the penis. They pushed skin or mucosa outwards and did not involve much of the erectile tissue. They were thus very different from this specimen, which is a bilateral one involving the whole of the crura of the corpus cavernosum and also extending towards the clitoris, though this was not removed.

A photograph shown to the meeting gave an idea of the size and position of the tumour before operation. It was subcutaneous and its distribution corresponded closely with what would be expected in consequence of any great enlargement of the corpora cavernosa. The condition was bilateral and the urethral and vaginal orifices lay between the two halves, and posterior to their anterior confluence. A successful attempt was made to save the clitoris, as the patient was in the twenties. So far there has been no recurrence of the growth in this position, but should such appear a local excision should suffice to cure it.

As the operation proceeded it became evident that removal of the tumour entailed its dissection down to the pubic bones, which were stripped bare where it had been in contact with them.

The specimen showed small areas of erectile tissue, in one or two places and it is from the muscular elements in this that the myoma has probably originated.

Description and histology (Professor Newcomb): "A bilobed tumour, the lobes being 9 by 6·5 by 3·3 and 9 by 5 by 2·6 cm. respectively, joined by a broad isthmus. On section, the surface is pale, firm and nodular with a few opaque spots. At the anterior end of the isthmus and at each lower pole, obvious cavernous tissue is present. Microscopically: A leiomyoma with a moderate amount of fibrous stroma. It consists of irregularly arranged bundles of smooth muscle which in parts are undergoing hyaline degeneration. The opaque spots are due to a fine deposit of calcareous material in some degenerate areas. In the cavernous parts there is considerable

[1] STAVIANICEK, *Ztschr. f. Urol.*, **7**, 635.

excess of muscle between the blood spaces. Considering its situation and appearance it would appear to be a leiomyoma of the crura of the corpus cavernosum."

Above : Normal corpus cavernosum and a centimetre scale.
Below : The tumour as it appeared on section after removal.

I should like to acknowledge the assistance I have received from Professor Newcomb in the preparation of this demonstration.

Proceedings of the Royal Society of Medicine Vol. XXXII 777

Section of Urology

President—H. P. Winsbury-White, F.R.C.S.

[*January* 26, 1939]

Some Observations on the Surgical Treatment of Urinary Incontinence

By Terence Millin, M.Ch.

Abstract.—Types: A. Essential. B. Paradoxical. C. False. D. True.

True incontinence.—A. Congenital: (*a*) Developmental abnormalities. (*b*) Malformations of nervous system. B. Acquired: (*a*) Local abnormalities. (*b*) False passages. (*c*) Disturbance of innervation.

Anatomy of sphincteric mechanism in male and female.

Diagnosis: Need for careful investigation including cysto-urethroscopy, cysto-urethrography, and cysto-manometry.

Treatment: A. Physiotherapy. B. Direct surgical repair. C. Surgical diversion of urine.

Types of true incontinence amenable to direct surgical repair: A. Epispadias. B. Aberrant ureteric ostia. C. Fistulæ. D. Congenital or acquired defective sphincteric mechanism.

Operative treatment of vesico-vaginal fistulæ.

Transvesical operation for cure of congenitally defective sphincteric mechanism—report of seven cases.

Stress incontinence.—Value of urethrograms to ascertain nature of defect. Operative treatment.

Incontinence following prostatic surgery.—Types of operation advocated.

New operative procedure utilizing ribbon catgut with demonstrative moving picture.

Résumé.—Types d'incontinence: A. Essentielle. B. Paradoxale. C. Fausse. D. Vraie.

Incontinence vraie.—A. Congénitale: (*a*) Anomalies du développement. (*b*) Malformations du système nerveux. B. Acquise: (*a*) Anomalies locales. (*b*) Fausses routes. (*c*) Troubles du système nerveux.

Anatomie du mécanisme sphinctérien chez l'homme et chez la femme.

Diagnostic: Importance d'un examen complet, employant la cysto-urétroscopie, la cysto-urétrographie et la cysto-manométrie.

Traitement: A. Physiothérapie. B. Réparation chirurgicale directe. C. Déviation des urines.

Types d'incontinence vraie susceptibles d'être traités par la réparation chirurgicale directe: A. Epispadias. B. Abouchement extravésical des uretères. C. Fistules. D. Défauts congénitaux ou acquis du mécanisme sphinctérien. Traitement chirurgical des fistules vésico-vaginales. Opération transvésicale pour les défauts congénitaux du mécanisme sphinctérien. Rapport de 7 cas.

Incontinence à l'occasion des efforts.—Valeur de l'urétrogramme pour vérifier le caractère du défaut. Traitement chirurgical.

Incontinence après intervention sur la prostate.—Types d'opérations recommandées.

Nouvelle opération utilisant le catgut en ruban, illustrée par un film.

Zusammenfassung.—Typen der Harninkontinenz: A. Essentielle. B. Paradoxe. C. Falsche. D. Echte.

Echte Harninkontinenz.—A. Angeborene: (*a*) Entwicklungsstörungen. (*b*) Missbildungen des Nervensystems. B. Erworbene: (*a*) Örtliche Anomalien. (*b*) " Fausses routes ". (*c*) Störungen der Innervation.

Anatomie des männlichen und weiblichen Sphincterapparates.

Diagnose: Notwendigkeit einer sorgfältigen Untersuchung, einschliesslich Cystourethroskopie, Cystourethrographie und Cystomanometrie.

Behandlung: A. Physikalische Therapie. B. Direkte Wiederherstellung durch chirurgische Massnahmen. C. Umleitung des Harnes durch chirurgische Massnahmen. Arten von echter Harninkontinenz, die direkt chirurgisch angegangen und dadurch wiederhergestellt werden können: A. Epispadie. B. Verlagerung der Harnleitermündungen. C. Fisteln. D. Angeborene und erworbene Defekte des Sphincterapparates.

Operative Behandlung der Blasenscheidenfisteln.

Transvesicale Operation für angeborene Defekte des Sphincterapparates. Mitteilung von 7 Fällen.

Blasenschwäche.—Bedeutung des Urethrogramms zur Bestimmung der Art des Defektes. Operative Behandlung.

Harninkontinenz nach prostataoperationen.—Die zu empfehlenden Operationen. Neue Operationen mit Anwendung von Bandkatgut, illustriert durch Filmvorstellung.

THERE are few more crippling disabilities than complete incontinence of urine. Not only does the victim suffer considerable physical inconvenience, or even misery, but there is that harder cross to bear—mental anguish.

Males so suffering are usually condemned, and I use this word deliberately, to a portable urinal or incontinence bag. All too frequently the skin of the penis—ill-adapted by nature to being constantly enveloped with a tight, urine-soaked rubber band—ulcerates, and adds no little to the victim's misery. I know of one suicide directly attributable to such a sorry pass. Our sisters suffering in a like manner are in a somewhat happier position, as a general rule, for surgery holds out a very real chance of cure. Should, however, the local lesion or the general condition of the patient preclude surgery, then the outlook is still blacker than in the case of the males, for no incontinence apparatus has yet been designed which can make even tolerably comfortable the female suffering from loss of urinary control.

Such an unhappy state of affairs appears to warrant more serious attention than has hitherto been paid by urological surgeons. A high proportion of successes has been gained by our gynæcological colleagues in the varieties met with in their practice. As a urologist I have been dealing with the problem now for some years.

Types of Urinary Incontinence

A. *Essential incontinence.* — An active form of involuntary micturition with apparently normal anatomical structure—so-called enuresis.

B. *Paradoxical incontinence.*—A passive form of overflow which occurs in certain forms of urinary retention, notably with obstructing prostate.

C. *False incontinence.*—Such as (1) periodic dribbling occasioned by urgency due to marked vesical or urethral irritability, the "urge incontinence" of Bonney; (2) involuntary loss of control such as occurs in extreme emotional states, excitement, fright, &c.

D. *True incontinence.* — A constant urinary leakage, resulting from a permanent dysfunction or structural defect in the urinary reservoir, or its sphincteric mechanism.

It is only with true incontinence that I wish to deal, and I believe it constitutes one of the major unsolved problems of urology.

There are two main types: I, Congenital; II, Acquired.

Congenital conditions associated with incontinence are:—

(*a*) Local malformations and developmental anomalies such as exstrophy, epispadias, extravesical ureteric orifices, and patent urachus.

(*b*) Malformations of the nervous system as seen in spina bifida.

Acquired causes are very numerous, and may be thus grouped:—

(*a*) Local abnormalities of structure as injury of the sphincters, either at childbirth or from surgery.

(*b*) False passages as vesico-vaginal fistulæ.

(*c*) Disturbance of innervation. Many lesions of the nervous system cause urinary incontinence. In tabes we see in the degenerative type the result of destruction, or, in the meningovascular type, the result of irritation of the involved roots. In the meningovascular type affecting the low cord there is an imbalance between the sympathetics and parasympathetics. The nerves of sacral origin which control the mechanism of urination, thus irritated, give rise to frequency or incontinence, according to the degree of involvement. On the other hand, if the low cord is destroyed with the sympathetics in control, a paradoxical incontinence will eventually result. This does not develop to the fullest extent immediately, but passes through a stage of bladder-wall decompensation, during which time we have the same night loss, and a somewhat similar day frequency, to that seen early in the meningovascular type. Spinal cord tumours, according to their location, may cause various types of incontinence. There are two types of incontinent bladder probably due to an autonomic nerve imbalance, which usually pass undiagnosed. First, that type where the intravesical pressure is low and the capacity is large. Bar obstruction at bladder neck should be sought for, and if found, endoscopic resection will often cure. Incontinence here is rather paradoxical in character. Secondly, the type often seen in precocious girls who suffer from incontinence at night ; here there is a normal capacity but high intravesical pressure.

Anatomy of the Sphincteric Mechanism Controlling Urination

The internal sphincter, unlike the external sphincter, is not a circular constriction of the vesical outlet, but an arrangement of considerable complexity. There are three components : (*a*) a detrusor ring, (*b*) urethral loops with internal and external portions, (*c*) urethral bands. The detrusor ring is a fibromuscular structure, best marked anteriorly and laterally ; it consists of a blending of the circular and anterior longitudinal coats. It is anchored by the pubo-vesical muscles. Lateral expansions are given off from this ring which sweep downwards and pass along the lateral aspects of the urethra ; these are best seen in the female, the prostate interfering with their continuity in the male. The urethral loops consist of both striped and unstriped muscle, and its external portion is derived mainly from the posterior longitudinal bundles. The urethral bands in the female are definite lateral extensions, partly from the fibromuscular ring, and partly urethral in origin. They merge with the prostate in the male. McCrea noted the presence of striped muscle in the trigone.

The external sphincter consists of striped muscle, and in the male is made up of three portions : (*a*) prostatic portion—the fibres arising from the anterior aspect of the prostatic urethra, disposed circularly, and being best marked towards the apex of the gland ; (*b*) the urethral portion or sphincter of the membranous urethra, situated between the two layers of the triangular ligament ; (*c*) urogenital portion or deep transverse perineal muscle. From the external sphincter in the female, fibres extend around the vagina, and, no prostate being present, spread more uniformly round the urethra. The part played by the pubo-cervical muscle sheet has been described by Victor Bonney (1923).

Diagnosis

I make no apology for stressing the importance of securing a careful clinical history. Frequently a tentative diagnosis can be made on the history alone. Let me quote one example to which I shall refer later, that of a girl aged 24 who had for years wandered from one hospital to another, seeking relief from her urinary incontinence which dated from birth. Questioning her elicited the fact that although she constantly leaked urine, every three or four hours she passed some 6 to 7 ounces in a perfectly natural manner. This suggested very forcibly that one ureter opened

normally into the bladder, but that the other had an aberrant termination. Investigation proved that this was the case.

Then the value of a thorough examination must be stressed. On this I shall not dwell save to emphasize the necessity of a complete neurological examination by an expert. In a case recently met with, this step might have saved the patient two unsuccessful operations. A colporrhaphy by an eminent gynæcologist failed to cure the incontinence, as did a transvesical operation by an equally eminent urologist. Disseminated sclerosis was the cause of the leakage. The tabetic cases should not be missed, though from time to time bladder symptoms may antedate the Argyll Robertson pupil and diminished or absent knee-jerks, all too frequently be taken as the criterion of tabes.

Cysto-urethroscopy and cysto-manometry have a very real place in the investigation. Fig. 1 shows cystoscopic view of tabetic bladder; fig. 2 the urethroscopic view of bladder neck in tabetic male with incontinence.

Radiography may show the presence of a spina bifida in congenital cases. It has been claimed by some that direct intervention and freeing of the spinal cord (division of the membrana reuniens and other fibrous attachments) will cure or improve some of these cases. The report of Mertz and Smith in 1930 on some 23 cases thus operated upon, was not very optimistic. In a paper emanating from a French clinic, a higher proportion of cures was claimed, but a number which appeared to give an immediate good result ultimately relapsed, due probably to reformation of further fibrous adhesions.

Cystograms and urethrograms can give very valuable information. Pictures should be taken in the erect posture, antero-posterior and lateral, with the patient relaxed and straining to void. Kennedy of New York has done some excellent work on urethrography in these cases of stress incontinence by means of inflatable bags filled with opaque medium, and Mr. Charles Read and I are at present engaged on some research in this connexion, endeavouring to correlate symptomatology, clinical findings, cysto-urethroscopy and cysto-urethrography. We hope to present our findings at a later date.

Treatment

This we shall consider under three headings :—

(*a*) Physiotherapy, or non-operative methods.

(*b*) Direct surgical repair.

(*c*) Surgical diversion of the urine.

Physiotherapy.—Minor degrees of incontinence, such as the partial leakage which may follow childbirth or surgical overstretching of the urethra, may be benefited or cured by appropriate exercises. This type not infrequently follows overzealous use of a hæmostatic bag after prostatic surgery, or by digital stretching of the female urethra to remove a foreign body—a procedure quite unjustifiable to the urological surgeon of to-day. The sphincteric mechanism may be strengthened by voluntary efforts of stopping and starting the stream during micturition, or better after filling the viscus with an antiseptic solution. Periodic dilatation, preferably with a Kollmann instrument, will often strengthen a weakened sphincter—a method particularly helpful in the dribbling of elderly multiparæ. In certain types of incontinence where the intravesical pressure is high, as proved by cysto-manometry, distension by fluid and maintenance at pressure of 60—70 mm Hg for five minutes, carried out thrice weekly, will often be beneficial (Rose, 1928). Electrotherapy too has its uses, faradic stimulation of the unstriped muscle governing urethral control being utilized.

Direct surgical repair includes a vast array of procedures, some of which are of value, and the majority of which are of doubtful utility. I shall return to this subject later, constituting as it does the main topic of this paper.

FIG. 1.—Cystoscopic view of fine trabeculation in bladder of tabetic female.

FIG. 2.—Urethroscopic appearance of bladder neck in tabetic male with urinary incontinence.

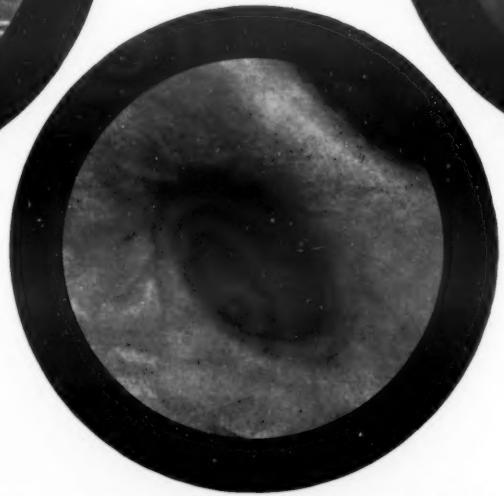


FIG. 3.—Urethroscopic view of ureteric orifice opening into urethra. Margin of bladder neck just visible.

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Surgical diversion, i.e. cutaneous or intestinal ureterostomy, has its indications in the treatment of incontinence mainly in cases of exstrophy and inoperable vesicovaginal fistulæ. In this country the fistulæ met with are seldom of the severe character experienced in less civilized communities, and, in practice, the only type calling for surgical diversion are those following radium burns where the surrounding tissues do not heal kindly. Formerly epispadias was in many clinics subjected to uretero-intestinal transplantation, but I feel that with a sufficiency of surgical dexterity, and, above all, patience, we can effect a satisfactory local repair.

Types of True Incontinence Amenable to Direct Surgical Repair.

(*a*) Epispadias.
(*b*) Aberrant ureteric orifice.
(*c*) Acquired fistulæ either following childbirth or surgery.
(*d*) Congenitally absent sphincteric mechanism.
(*e*) Acquired deficient sphincteric mechanism following childbirth or surgery.

Epispadias.—The success of direct surgical attack depends upon extensive freeing of the vesical neck beneath the pubic band, and by a rather tight reconstruction of the vesical sphincter. When the urethroplasty is being carried out, the sutures which are placed beneath the pubic band and along the corpora cavernosa may have a tendency to shut off the blood supply of the corpora and of the glans penis, so that these must be watched most carefully.

Aberrant ureteric orifice.—It is well known that one or both ureters may open aberrantly through some developmental error, the ostium being in the urethra, vestibule, vagina, or in the uterus. Only two such cases have come my way to date. The first, already referred to, and which I am reporting through the courtesy of my colleague, Mr. Attwater, was a girl aged 24, who for many years had been attending the out-patient departments of several hospitals for an incontinence dating from birth. She had been cystoscoped several times, but the fact that no ureteric orifice was present on the right side had passed unnoticed. Urethroscopy showed an opening in the floor of the urethra just below the bladder neck (figs. 3 and 4). Into this opening a catheter could be passed only a short distance; retrograde pyelography was attempted, but failed owing to reflux of the opaque medium. Plain skiagraphy showed the right kidney to be filled with stones. A nephrectomy carried out by Mr. Attwater cured the incontinence. The second case I had the privilege of seeing in a clinic I was visiting, the ureter opening into the prostatic urethra.

In my studies of the literature I have come across little mention of congenital incontinence in girls apart from those associated with lesions of the nervous system as seen in spina bifida. Lowsley states in one paper that he has had five such cases, but gives few details. Frankenstein also operated upon one such case. I have seen and operated upon seven of these hapless souls, with the most gratifying results. The ages of these girls ranged from 5 to 21. All were virtually completely incontinent, and were odoriferous objects of odium to their relatives and friends. In none was any obvious cause found to account for the dribbling. Neurological and radiological examinations were negative. Cystoscopy showed a normal bladder and ureteric orifices. Blood and cerebrospinal fluids were Wassermann negative. Endoscopy of the bladder neck with a forward-looking telescope gave the characteristic picture of a patulous outlet. On this finding the diagnosis was made and surgical intervention advised. In every case the operation was readily accepted. In view of the youth of the patients (the first was aged 7), and the smallness of the vagina, a transvesical approach was employed. The suprapubic view of the internal meatus showed a widely open sphincter which readily admitted the tip of the little finger. The upper urethra was stretched digitally to facilitate removal of part of the floor (fig. 5). A wedge was then resected from the bladder neck posteriorly as shown in fig. 6, the lateral incisions being carried down into the urethra as low

as possible. A series of transverse sutures were then introduced by means of a Boomerang needle, and the urethra and bladder neck tightened thus about a No. 4 rubber catheter. The uppermost suture was a mattress one, the aim being to gather as much muscularis as possible at the bladder neck, reconstituting, as it were, an artificial uvula of Lieutaud. When the sutures had been tied (fig. 7), the catheter was removed and the bladder closed about a Pezzer tube, or, as in my later cases, about a double suction tube. Suprapubic drainage was maintained for ten days, at the end of which time the tube was withdrawn and the fistula allowed to close. Whilst the tube was in position, no bladder lavage was employed, merely the daily instillation of 2 drams of 2% mercurochrome, or 1/2,000 acriflavine. In most cases the patient was ready to leave the hospital in three weeks, and no case was hospitalized for more than twenty-eight days. In every case the ultimate functional result was perfect. Several of the cases complained of some difficulty in voiding during the first week or two, but this symptom invariably disappeared, and all

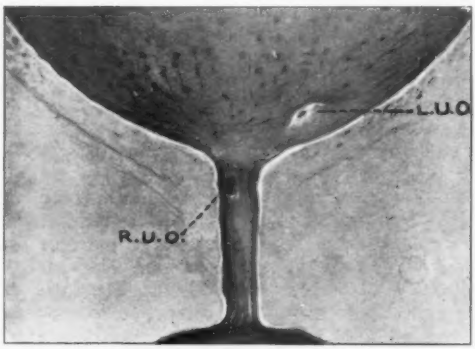

FIG. 4.—Schematic drawing of case illustrated in fig. 3.
L.U.O.: Left ureteric opening.
R.U.O.: Right ureteric opening.

FIG. 5.—Dilated internal meatus after digital stretching.

were checked up six weeks after operation for evidence of residual urine. In none did it amount to more than a few c.c. Only two were subsequently cystoscoped, one a year after operation, and no vesical trabeculation was present. The first case was operated upon eight years ago. That this procedure is not novel I am aware, but a review of the literature seems to show that not infrequently it was only partially successful. I feel that adequate suturing of the bladder neck was not obtained, and as far as I can see, the closure was done about a larger catheter than I employ. Lowsley, dissatisfied with the results of an analogous operation, proposed a subpubic approach with a resection of a wedge from the superior aspect of the bladder neck and urethra. This, I believe, is an erroneous conception having regard to the structure of the fibromuscular ring at the bladder neck.

It is possible that an equally good result could have been obtained by a transvaginal approach, but the smallness of the parts led me to adopt the approach I have described.

Of the fistulous cases I propose to say little save this, that I believe the majority of vesico-vaginal fistulæ should be attacked through the bladder. I know full well that many can be cured by a transvaginal procedure, but I also know a great many are not. Three of the cases which have come my way had previous attempted

cures by gynæcologists of repute. As the leakage is essentially from the bladder into the vagina, it is all-important to secure a watertight closure at the entrance of the fistula, i.e. at the vesical end. It is manifestly easier to do this, securing the necessary inversion of the bladder mucosa and muscularis transvesically, so I stoutly advocate this approach. The repair of the vaginal mucosa is of secondary importance. A careful freeing of the edges of the fistula with undermining of the muscularis, followed by suturing of the connective tissues between bladder and vagina, and finally a continuous suture of the bladder wall and mucosa, should rarely, if ever, be followed by failure. A Boomerang needle is almost indispensable. As in all plastic procedures on the urinary tract, a diversion of the urine is necessary, and here the double suction suprapubic tube for 10–14 days is best.

Other fistulæ such as uretero-cervical, uretero-vaginal, and uretero-cutaneous call for anastomotic repair or nephrectomy, according to the degree of infection present, the amount of pelvic dilatation, and the time which has elapsed since the fistula has developed.

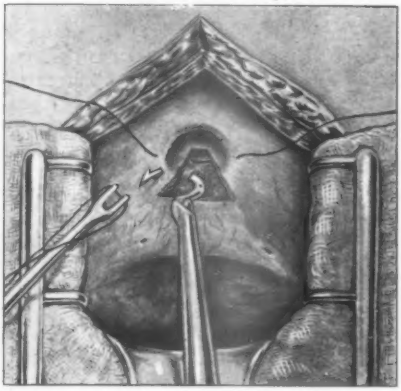

FIG. 6.—Introduction of sutures following resection of wedge of posterior lip of meatus.

FIG. 7.—Appearance of meatus after sutures have been tied.

Stress incontinence following childbirth is particularly amenable to surgical repair. A careful suturing of the peri-urethral tissues as so meticulously laid down by Mr. Victor Bonney, will cure a large proportion. There remains, however, a small group which do not gain complete control after what has been apparently a most carefully executed transvaginal tautening of the sphincter, and it is this group about which I should like to say a few words.

Cystoceles may be grouped thus :—

(*a*) Those anterior to inter-ureteric or Mercier's bar.

(*b*) Those posterior to Mercier's bar.

(*c*) Combined types.

Group (*a*) may be further subdivided into :—

(1) Those with normal fixation of the bladder neck, in which a thinning out of the trigonal muscle allows a pouch to form between the sphincter and the inter-ureteric bar.

(2) Those where dislocation of the bladder neck and urethra has occurred, and the trigone as a whole descends along with the bladder neck.

By means of cysto-urethroscopy and cysto-urethrography one can differentiate between these various types, and I feel that before operative repair is planned it is

important to have all the data available. Mr. Bonney in his communication to the Gynæcological Section some years ago on " Diurnal Incontinence in Women " stated " there are occasional cases in which the operation (transvaginal tautening of the vesical sphincter) fails ; in some, the initial tautening may have been insufficient ; in the remainder I think the reason for failure is that attachment to the bone and subpubic angle of the pubo-cervical muscle sheet and 'peri-urethral wedge' has become loosened beyond what can be repaired from below ". I suggest that by means of urethrograms one can tell this type, and plan the appropriate suprapubic operation, either ventri-fixation of the bladder as advocated by Mr. Bonney, a Goebell fascial sling about the bladder neck, or the plastic procedure on the vesical outlet as I have described for the congenital incontinence cases. In this latter connexion I should mention that I have operated upon five such cases by this intravesical technique after a transvaginal operation had failed, and in all I have secured a perfect result. In the first case I carried out a Goebell sling, using ribbon catgut combined with the intravesical plastic suturing, but I have omitted the sling in the last four cases without losing anything in the ultimate result.

Incontinence in males, excluding those of neuropathic origin, is usually the result of surgery. In former times it resulted not infrequently from lateral lithotomy. The first case I saw had been operated upon by Zuckerkandl many years before ; the stone had been secured at the expense of urinary control. Most of the cases seen since have followed prostatic surgery. We see fewer cases of incontinence here than in America because of the infrequency with which perineal prostatectomy is carried out. It is estimated that suprapubic prostatectomy is followed in approximately 1% of cases with some loss of urinary control, and the perineal operation in 5–10%, according to the skill of the operator (Goldstein 5·8% ; Hinman 9%).

Transurethral resections may also be followed by this unpleasant complication when the verumontanal landmark is overlooked, and the external sphincter inadvertently resected. In view, probably, of the relative infrequency with which the condition is met in this country, British urologists appear to have contributed little or nothing to the literature in the treatment of incontinence in the male. The late Sir John Thomson-Walker in his textbook stated : " where incontinence follows prostatectomy, recovery or improvement may take place by the perineal muscles assuming control. In perineal prostatectomy, Young has operated with success. If not, the patient will have to wear a urinal." A sorry admission, and a definite blot on the escutcheon of urology.

The German and American literature contain a number of articles on the subject, with sporadic case reports each advocating a new operation—proof positive that the ideal has not been found. The various operations which have succeeded are based on the theory that the difference between complete incontinence and complete dryness is not the difference between a widely open tap and a tightly closed one, but rather the difference between a tap that drips slightly and a tightly closed one (Keyes, 1926). One may therefore expect at least in a certain proportion of cases to close such a dripping urethra by relatively slight or indirect pressure. The effect of this is seen in the compression of the urethra by mattress suturing of the peri-urethral tissues in the incontinence of women as cured by gynæcologists.

The various operative procedures devised to remedy the condition fall roughly into two groups :—

(1) Those aiming at decreasing the calibre of the urethra by a plastic procedure causing external compression of the canal.

(2) Those consisting in actual removal of tissue, usually a wedge at the neck of the bladder (Young), or the roof of the urethra (Lowsley).

The operations aiming at the substitution of another muscle for the deficient sphincter really fall into the first group in that external compression of the urethra is obtained. A large number of muscles have been utilized for the purpose, the two

most commonly employed being the pyramidalis together with a strip of the rectus sheath (Goebell-Frangenheim-Stoeckel), and the Gracilis (Giordano, Deming, Player, and Callender).

The various operative procedures may be tabulated thus :—

(1) *Plastic operations on vesical sphincters and urethral walls.*

A.—Extravesical :—

(*a*) Plication of peri-urethral tissues (Bonney, Kelly, Marion).

(*b*) Excision of wedge from posterior aspect of bladder neck or posterior urethra (Frank, Young).

(*c*) Excision of wedge from anterior aspect of bladder neck and urethra (Lowsley).

B.—Intravesical :—

Excision of wedge from posterior lip of bladder neck (Young, Smith).

(2) Transplantation of voluntary muscle or fascia round urethra.

(*a*) Pyramidalis (Goebell, Frangenheim, Stoeckel, Miller).

(*b*) Rectus abdominis (Giordano, Frangenheim).

(*c*) Levator ani (Taussig, Squier, Keyes).

(*d*) Adductor (Le Fort).

(*e*) Gluteus maximus (Sellheim).

(*f*) Gracilis (Giordano, Deming, Player and Callender).

(*g*) Fascial transplants (Jarecki, Price, Bedrna).

(*h*) Round ligaments (Solms).

(*i*) Ribbon catgut (Lowsley, Millin).

Keyes reported a case in 1926 where the condition had followed perineal prostatectomy. On reopening the perineum he found very little bulbo-cavernosus muscle left. Accordingly he sutured the posterior portion of the remnants to the levatores ani on each side, securing a muscle sling which exerted the necessary pressure to ensure a lack of dribbling. In his case he inadvertently opened the membranous urethra, and so carried out a suprapubic cystostomy to keep the operative field dry. This case was in hospital three months. No control was present for four weeks, and full continence was not obtained for eleven months. Franz in Germany, and Bentley Squier in America reported cases where a similar technique secured a good result.

Bedrna in Czechoslovakia isolated the membranous urethra, and encircled this portion of the canal with a loop of fascia lata, the free ends being sutured to the inferior layer of the triangular ligament. This necessitated separating the bulbo-cavernosus from the central point of the perineum, and nicking the superficial and deep transverse perineal muscles on their dorsal aspect. Suturing was done about an 18 Charrière catheter. He naively states that the wound healed without any great suppuration. The catheter was left in for seven days, and on its withdrawal the patient was continent. It is also noteworthy in his report that the penis retained its erectile power and sensitivity.

The most commonly employed operation in the literature appears to be the gracilis transplant operation first described by Giordano in 1907, and originally used for females. Deming in 1926 reported first case in America. Player and Callender in 1927 reported three cases in which this technique was employed successfully in males. The operation I am about to describe is analogous, but I think that I have proved that the use of the muscle or fascia transplant is unnecessary, and that ribbon catgut is adequate. It has always seemed to me extremely unlikely that the free end of the muscle remains muscular tissue, more especially as not infrequently in these cases some local sepsis is present.

Lowsley in a comprehensive paper two years ago advocated the use of ribbon catgut, but he employed it merely to plicate the bulbo-cavernosus muscle, believing that in this way he could secure adequate pressure on the underlying urethra. I

attempted this procedure in one patient suffering from complete incontinence following prostatectomy elsewhere two years before, but secured no improvement whatever. I am so well pleased with my newer operation that I propose carrying this out shortly in this patient. It is possible that this reefing of bulbo-cavernosus is all that is necessary in minor degrees, but I feel that in the complete variety, firmer encircling of the urethra is necessary, so I lap the freed corpus spongiosum as closely as possible to the membranous urethra with two turns of chromic ribbon catgut which is $\frac{5}{8}$ in. wide.

Steps of Operation

The operative field being the perineum, a thorough shaving of the area is carried out, using preferably an electric razor which avoids any excoriations of the skin. Careful antiseptization of the skin, including penis and scrotum, is made before towelling. A No. 20 Charrière sound is passed down the urethra to the bulb, and held in the mid-line by one assistant. The scrotum is drawn up on to the abdomen,

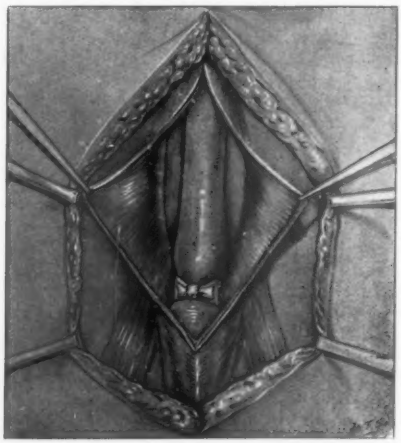

Fig. 8.—Ribbon catgut encircling loop tied about corpus spongiosum.

and fixed on each side by means of a clip. A median incision is then made commencing anteriorly at the root of the scrotum, and ending posteriorly at the central point of the perineum. It is carried through Colles' fascia, which is then retracted laterally on each side. Blunt dissection exposes the bulb covered by the bulbo-cavernosus muscle, and the ischio-cavernosi are seen on each side, together with the inferior layer of the triangular ligament. The perineal arteries, branches of the pudic, which supply the superficial perineal compartment, may or may not be ligated as they pass over the superficial transverse perineal muscles. The bulbo-cavernosus muscle is then divided along its median raphe, and the two halves of the muscle drawn laterally by means of Allis clamps. Scissor dissection then separates the corpus spongiosum with its contained cavernous urethra from its relatively loose attachment to the triangular ligament. This is carried out until the corpus spongiosum is freed posteriorly from the point where the urethra pierces the triangular ligament, anteriorly to the union of the spongiosum to the corpora cavernosa. On elevating the corpus spongiosum, two fingers may easily be passed beneath it. The ribbon catgut is then passed twice round the spongiosum, and tied rather firmly over the urethra still embracing the sound (fig. 8). This suture should be placed

as far back as possible, i.e. close to the site of the faulty external sphincter. The bulbo-cavernosus muscle is then, by means of the ribbon catgut, sutured snugly about the corpus spongiosum, and when this has been completed (usually 3 sutures suffice), the sound is withdrawn, and a well-lubricated rubber catheter, size 18 Charrière, is passed into the bladder, and fixed to the glans penis by means of a silk-worm stitch. Colles' fascia is closed by means of a continuous No. 0 catgut stitch, and the skin closed with silk-worm gut without drainage. The catheter is left in for ten days. On its withdrawal there may be some difficulty, and six-hourly catheterization may be necessary for some days. Whilst the catheter is in situ the usual bladder lavage and oral antisepsis is employed.

Lowsley's animal experiments showed that the resorption of ribbon catgut is associated with fibrous tissue formation, and the compression effect seems to be permanent. As to the possibility of stricture formation, we can as yet say little, save that in one of my cases (complete incontinence after prostatectomy elsewhere) done three and a half years ago, there has been no evidence of narrowing as I cysto-urethroscoped this patient some two months ago. Even should stricture occur, it would appear to be the lesser of two evils.

Personal Results

Females.—Seven cases of congenital incontinence. Intravesical reconstruction of internal sphincter—all cured.

Five cases of stress incontinence where transvaginal operation had failed. Intravesical reconstruction of internal sphincter—five cured.

Males.—Seven cases.

One intravesical reconstruction—failure.

One reefing of bulbo-cavernosus—failure.

Five perineal urethroplasties. Three cures. Two too recent to include.

Finally, my apologia for this paper, sketchy though it admittedly is :—

(*a*) Necessity for thorough investigation of all cases of urinary incontinence.

(*b*) Desirability for fuller co-operation between gynæcologist and urologist in cases of doubtful structural defect.

(*c*) Suggestion that transvesical operation, after the manner I have described, may be called for in certain cases of acquired stress incontinence of women as well as in the congenital type.

(*d*) Hope that my fellow urologists will give the ribbon catgut technique a trial in cases of urinary incontinence in the male.

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Discussion.—Mr. VICTOR BONNEY said that there were two common forms of urinary incontinence in adult women, stress incontinence and urge incontinence. Stress incontinence was due to a failure of the sphincteric mechanism.

The principal component of this mechanism was the pubo-cervical musculo-fascia which lies between the base of the bladder and the vagina and which is perforated by the urethra as it leaves the bladder.

The fibres of the pubo-cervical fascia are attached above to the vault of the vagina and the front of the supravaginal cervix whilst below they blend with a wedge-shaped block of tissue which surrounds the urethra. The lower boundary of this block of tissue is the lower inch and a half of the anterior vaginal wall. The lateral boundaries are in relation with and attached to the rami of the pubes and the edges of the levator muscles, whilst its base is composed of the triangular ligament, and superficial to it, Colles' fascia.

Childbirth sometimes causes the attachments of this block of tissue to become loosened with the result that a sudden strain, like coughing, was accompanied by an excessive " swinging-round " movement of the urethra under the pubic arch, and when, as the result of it, the meatus looked directly forwards, a spurt of urine escaped.

In a true case of stress incontinence, if this extravagant excursion was prevented by means of a finger inserted in the vagina on either side of the urethra no amount of coughing or straining would cause urine to escape. This was the test for stress incontinence on which the advisability of operating should be determined. Patients coming for examination should be asked not to empty the bladder before entering the consulting room. If the escape does not occur with the patient lying on her back or on her side it should be tried for in the standing posture, and if in none of these postures it can be detected the complaint should be regarded as " non proven ' for no operation should be entertained unless the surgeon has himself seen the leak.

Stress incontinence was almost entirely limited to patients who had borne children and its alleged occurrence in nulliparæ should always be viewed with suspicion and no operation undertaken until the reality was quite certain. Stress incontinence could practically always be cured by the operation he had devised many years ago and which was described in " A Textbook of Gynæcological Surgery " ; provided of course that it was properly carried out and good healing obtained. Of recent years he had given up the use of buried sutures and relied entirely on the mattress sutures transfixing the vaginal wall. There were two important points in inserting these mattress sutures—first, they must be inserted very wide of the middle line, and secondly the lowermost of them should be so placed that its lowermost limb was on a transverse line corresponding to the anterior margin of the meatus. While the mattress sutures are being tied the urethra should be held in the subpubic angle by a sound.

He was of opinion that in cases of stress incontinence none of the various elaborate operations that have been devised for its cure should be entertained unless his operation had been tried first.

Urge incontinence was a totally different proposition, for here the detrusor muscle received a sudden and violent reflex stimulus from somewhere about the urethro-vesical junction. It was easy to mistake urge incontinence for stress incontinence since in both the wetting occurred in the daytime when the patient was up and doing. Stress incontinence, however, was purely involuntary and entirely unpreceded by any sensation that urine was going to pass, whereas urge incontinence was preceded over a short period by a desire to micturate so imperious that unless the sufferer could instantly go to a lavatory she wetted herself.

Professor JAMES YOUNG said that Mr. Victor Bonney had discussed those cases of urinary incontinence in the female which were due essentially to mechanical factors, towards the elucidation of which he had contributed so much.

Professor Young wished to refer to another large group in which frequency of micturition,

diurnal and nocturnal, with or without urge and stress incontinence were present with no obvious local pathology to explain them. The urine was pus-free and sterile and there was no recognizable pathology in the urinary tract. Many such cases belonged to the clinical condition which Professor Young had termed the " cervical syndrome ". They were characteristically women who dated their symptoms from a birth or abortion. Classically their complaints were leucorrhœa, frequency with or without urge incontinence, dyspareunia and pain in the lower abdomen, more often in the iliac fossa and especially the left iliac fossa. He had been first attracted many years ago to a study of the urinary dysfunction in such women by finding that, when treatment directed to the cervix led to relief of the leucorrhœa and pain, the bladder irritability often cleared up at the same time. Further, in more intractable cases a " blockage " of the sympathetic plexus with alcohol or such an oily alcoholic preparation as proctocaine usually led to an immediate relief of even the most extreme degrees of urinary distress of the above-mentioned type.

It seemed clear on several grounds that this bladder irritability was essentially due to a disturbance of the normal neuromuscular control : (1) the absence of any intrinsic urological pathology, (2) the quick response to " blockage " of the nerve tracts, and (3) the fact that in many instances the relief lasted for a period of only three to four months.

In the beginning the method of nerve block was introduced with the object of cutting off afferent pain impulses but it was difficult to explain the relief in the bladder symptoms on similar lines. That the procedure here was more peripheral in its action was suggested by the cases in which there was a complete relief in stress incontinence.

The routine treatment directed specially to the urinary symptoms consisted of the injection of 2 to 2½ c.c. of proctocaine along each side of the front of the cervix at the level of the bladder base.

He cited three cases by way of illustration :—

Case I.—Aged 38. Para 3. Case of cervical syndrome. Complained for three years of incontinence of urine, the urine coming away as a constant drip whilst she was up and about. At night no incontinence but had to rise two or three times. After nerve block there was complete and immediate relief of the abdominal pain and of the incontinence and urinary frequency.

Case II.—Aged 47. Para 1. Complained of diurnal frequency (20 to 30 times), nocturnal frequency (6 to 10 times) and urge incontinence present for two years since insertion of radium into the uterus for severe menorrhagia. Nerve block of bladder base gave immediate relief, the frequency diminishing from 30 to 40 times to four to five times a day. The relief lasted only three months but a second block had given relief which up to date had lasted eleven months.

Case III.—Aged 35. Para 4. Since last birth she had complained of (*a*) left iliac fossa pain, (*b*) dyspareunia associated with immediate and uncontrollable desire to micturate, (*c*) frequency, urge and stress incontinence. Relief of all symptoms was immediate after nerve block.

Mr. F. McG. Loughnane : The surgical operations we have had explained to us do not appear to me to be based on sound principles. Mr. Millin advocates cuneiform resection of the vesical urethral orifice, or a ribbon suture tied round the corpus spongiosum, proximally, a suitable-sized bougie being in the urethra to prevent the ligature being tied too tightly. The initial part of the operation described by Mr. Victor Bonney is narrowing of the urethra by plication. All these might be called stricture-producing operations, or irresilient narrowing of the urethra. The cause of stress incontinence is failure of the muscle, i.e. of the sphincter, to function adequately. I think that there are only two surgical procedures to remedy this : one is to strengthen existing muscle, and the other to replace the faulty muscle with a new one.

In 1926 Deming of America described an operation, transplantation of the whole gracilis muscle, to repair a case of female epispadias with exstrophy of the bladder. The following year I performed a modification of this operation in a case of stress incontinence, with such success that I have performed the operation repeatedly since then, with most gratifying results. The operation is not difficult. The urethra is dissected out for about an inch to an inch and a half : the gracilis muscle is then exposed in the thigh and a suitable strip isolated and mobilized, drawn through a tunnel into the vagina, and sutured around the urethra. The free end of the muscle must be sutured to the pubic bone, in accordance with modern orthopædic teaching. About ten days after the operation the patient should be sent to the electrotherapeutic department for stimulation of the gracilis muscle, and to be taught how to contract the adductors voluntarily.

Criticism has been made that in a short time the muscle graft will become fibrous tissue, and then function merely as a constricting band. This is not so, because I have had patients return some nine months later complaining of a recurrence of symptoms, who after a week of electric stimulation of the muscle and of exercises have recovered full control.

Mr. E. W. RICHES showed the pyelogram of a case referred to him by Mr. Bonney. This was a woman, aged 24, with life-long incontinence which was unrelieved by the operation for stress incontinence.

Cystoscopy showed two normal ureters opening into the bladder and an abnormal one opening into the urethra, and pyelograms showed this abnormal ureter to lead from the dilated upper pelvis of a kidney with complete reduplication of the pelvis and ureter. As the urine from this pelvis was infected and of low urea content, it was decided to treat the case by heminephrectomy rather than by implantation of the ureter into the bladder, and this operation was followed by no further leakage. The case has been described in full elsewhere by Winterton (1937).

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The PRESIDENT said that some of the less important forms of incontinence were often quite simple to treat surgically, for example: those cases which one saw quite frequently where there was some atresia of the external urinary meatus in young children. By doing a simple meatotomy and carefully supervising this for a week subsequently, and then following with an occasional urethral dilation many of these cases were cured while others were improved. He had dealt with a large number of these cases and it was exceptional to have to admit total failure with this line of treatment. Even with the female children, urethral dilatation carried out occasionally often had a wonderful effect. There seemed no doubt that the explanation of this benefit was that the stretching of the urethra diminished the mild inflammatory state which was often present in this part in these children.

One sometimes met with patients in adolescence and they should be dealt with in the same way. Only recently he had a case of nocturnal enuresis in a boy, aged 17, who had only started wetting the bed since the age of 14. He had a very definitely congenitally stenosed external urinary meatus. One came across a certain number of female adolescents whose incontinence dated from after puberty. Invariably such cases, where associated with a non-specific inflammatory condition involving the genitals and urethra, particularly the cervix, were always rectified by the dilatation and cauterization of the cervix and an occasional urethral dilatation. It was very interesting to consider the way in which an infected kidney could be responsible for incontinence of urine and he recounted a case in a boy aged 16 who had had nocturnal incontinence for several years, which was cured at once by removing an infected left hydronephrosis.

The President agreed entirely with Mr. Millin in his observations that cases of vesico-vaginal fistula should be repaired through the bladder. He had been able to cure a number of such cases in this way after surgical treatment had failed by an approach from the vagina alone.

Mr. Millin had mentioned incontinency of urine following perineal prostatectomy: there were two principles to be observed to avoid this, one was to keep away from the compressor urethræ, and the other to be able to stitch securely the neck of the bladder to the stump of the urethra. If these two matters were faithfully attended to, his experience was that there could be no incontinence of urine.

Section of Radiology

President—H. K. Graham Hodgson, C.V.O., F.R.C.P.

[*February* 17, 1939]

The Radiology of Acute Respiratory Disease

By Peter Kerley, M.D.

Acute respiratory diseases in the textbooks fall into well-defined groups and are neatly labelled under half a dozen headings. Yet there is no chest physician who will not admit that he is constantly meeting with cases which conform to no textbook description—and this, not because of complications but because the disease is running an aberrant course from the beginning. Even that classical disease, lobar pneumonia, is showing more and more often a complete disregard for the textbook rules.

The most difficult of the acute chest problems have to be investigated with portable X-ray apparatus, and in view of the fact that this work is frequently carried out by laymen and the films later passed on to radiologists, a few words about portable technique may be helpful. There is nothing to be gained by elaborate apparatus or technique. The less fuss and bother in the room and the less apparatus, the better for a patient often grievously ill and alarmed about himself. In acute chest work one is seldom if ever confronted with a problem requiring very fine detail. Speed is important but not vital, for a consolidated or compressed lung does not move much. There is therefore no point in working at a long distance, and 2 ft. 6 in. to 3 ft. is ample. A careful screen examination is most important. My usual procedure is to lift the patient up and let him lie back against the screen in the sitting position. On the screen watch the mediastinal movements and if possible the diaphragmatic movements. Where the shadow of a consolidated base is completely merged with the shadow of the diaphragm, it is often possible by screening to detect a slight movement which allows one to localize the position of the diaphragm, using the healthy side as a check. Not infrequently it is impossible to get pictures without blurring, either because the respiration rate is too high or because the patient is too ill or too young to co-operate. In such cases the screen examination may be decisive.

I believe that the manufacturers have made a grave mistake in attempting to make portable sets too portable and thereby restricting the screening facilities. The period of twenty-five seconds which is the maximum permissible screening time with the sphere type of apparatus is inadequate. The actual radiography is simple—take plenty of films and always overexpose or overpenetrate two—these are the pictures on which fluid and consolidation can be differentiated. Finally, never leave the room without taking a lateral view. Don't rely on the clinical signs to tell you which lateral view to take—screen the patient and find out for yourself. The ætiology of acute lung diseases is the same in infancy and adult life, but the frequency, course, and potential complications, are often dependent on the age of the subject. For this reason a rough classification of lung diseases in children and in adults is essential.

Acute Miliary Tuberculosis.

The best-known, but by no means the most frequent of acute respiratory diseases in children is miliary tuberculosis. The disease is caused by erosion of a tuberculous lesion into a blood-vessel or into the thoracic duct. It is not possible to determine by radiological or clinical methods whether the method of spread is hæmatogenous or lymphogenous, nor are the size of the individual foci dependent on the method of spread. In some cases the foci are all millet seed in size, while in others they are larger and rounder. The usual appearance in infants up to the age of about nine months is a fairly large caseating pneumonic area in one lung with widespread dissemination of fairly large round foci all over both lungs. In older children and adults we seldom see a localized pneumonic area but only the widespread infiltrations which may be millet seed or larger or a combination of both. The common absence of a pneumonic focus in these older children is held by some to be in favour of a primary glandular infection. The disease in children is almost invariably fatal although its course may be as long as six or nine months. There are about a dozen recorded cases of recovery in children, but I think only three of these satisfy the essential diagnostic criteria. The pathological significance of the difference in size of the individual lesions is not clearly established, but it most certainly does not influence the prognosis. This point is worth stressing because it has been assumed that the finer and more discreet the lesions, the better the outlook. There are no X-ray appearances which are a guide to the severity or otherwise of the disease.

The Pneumonias in Children.

The commonest acute chest disease in children is *bronchopneumonia*, which may be primary or secondary. Roughly speaking infants tend to develop a form of bronchopneumonia localized to the paravertebral sulci, and older children tend to get bronchopneumonia of a more diffuse type. The incidence of lobar pneumonia is rather haphazard, but it seldom attacks infants or children below the age of 4 or 5 years.

The visibility of bronchopneumonic foci is dependent on their size and number, on their proximity to the X-ray film, and on the presence or absence of compensatory emphysema. In infants the foci are usually small and lie deep in the paravertebral fossæ, a site which to all intents and purposes renders them invisible to X-rays. In severe cases the foci spread out peripherally at one or both bases where they coalesce and are easily seen as large mottled areas of consolidation. In several standard works on this subject there are X-ray illustrations said to be typical of paravertebral pneumonia. The dominant feature is a dense homogeneous opacity with a well-defined outer border running parallel to the mediastinum and extending from apex to base. It is usually a couple of inches wide. There are three facts which prove that these appearances cannot be due to paravertebral bronchopneumonia : (1) The homogeneity of the shadow is not a feature of bronchopneumonia. (2) The sharp outer border is the last thing one expects to see in a disease affecting only groups of lobules. (3) The distribution of the shadow transgresses lobar divisions without a break. Part of the upper as well as the lower lobe lies in the paravertebral sulcus and there cannot in this area be a continuous consolidation from top to bottom with a sharp outer border in either bronchopneumonia or lobar pneumonia. This shadow represents a mediastinal effusion and it appears to be a frequent complication of paravertebral bronchopneumonia in young children. The effusion may remain encysted in the mediastinal leaves or it may extend the whole way round the pleural cavity. This type of effusion is not often seen in older children.

Between the ages of 2 and 10 years bronchopneumonia occurs in two distinct types. In the commoner type the foci are large and ill-defined and may coalesce to form a consolidation almost lobar in extent. It can be differentiated from lobar pneumonia in that the consolidation does not extend into the root of the lung. It is

often associated with considerable enlargement of the bronchial glands, and this is a most important point in the differentiation from tuberculosis. In children the bigger the glandular enlargement the less likely the condition is to be tuberculous.

FIG. 1.—Bronchopneumonia in an infant aged 9 months. Collapse of the right lower lobe with a mediastinal effusion.

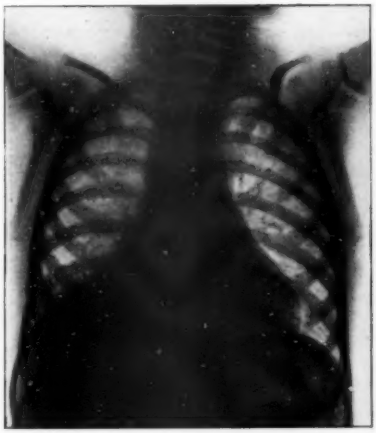

FIG. 2.—The same patient aged 18 months. The mediastinal effusion has cleared up but the lower lobe is still more deflated.

FIG. 3.—The same patient aged 9 years with bronchiectasis of the partially collapsed middle and lower lobes.

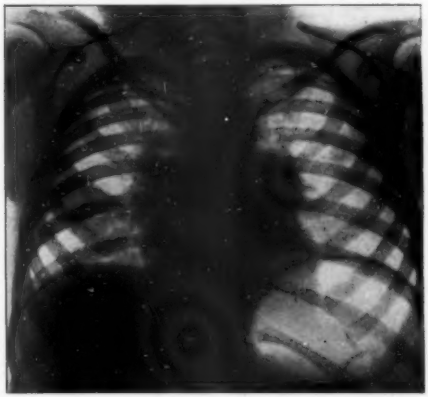

FIG. 4.—Bronchopneumonia in a child aged 4 years. Gross enlargement of the bronchial glands. Mantoux test negative.

Another useful diagnostic feature which is often present in bronchopneumonia is compensatory emphysema.

In the second form of bronchopneumonia the foci are small, moderately well defined, and do not tend to coalesce. This form is sometimes referred to as miliary

bronchopneumonia and is apparently common as a complication of measles. I have seen it occur as a primary infection with Type I pneumococci. It can hardly be confused with miliary tuberculosis, for the foci are larger and rougher and less numerous, and a striking feature is the translucency of the lungs despite the extensive consolidations.

Bronchiolitis is a rare acute disease in which only the finer bronchi are attacked

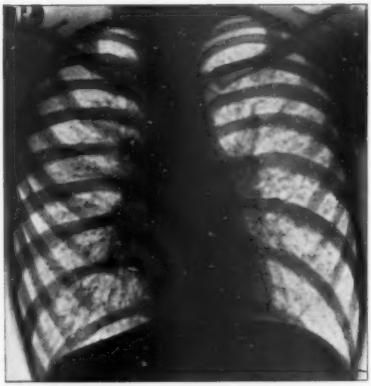

FIG. 5.—Miliary bronchopneumonia.

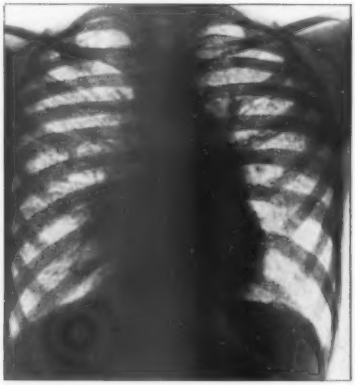

FIG. 6.—Bronchiolitis obliterans

FIG. 7.—Bronchopneumonia at the right base with lamellar effusion.

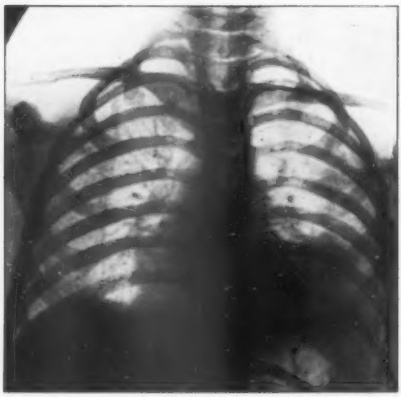

FIG. 8.—Bronchopneumonia left base with collapse of the left lower lobe and a small effusion. Disease began three days after tonsillectomy. Recovery in four weeks.

and plugged with secretion. It is usually secondary to some other severe infection. Physical signs in the lungs may be negative but there is cyanosis and dyspnœa. The X-ray appearances are not at all well known. Fig. 6 is an example occurring during a general septicæmia. The essential features are a multiplicity of very fine

lines following the ramifications of the bronchial tree and probably representing the inflamed and blocked tubes. This child recovered, but I have been unable to get her back for re-examination ; the mother writes that the child is well.

Bronchiolectasis is a term which should be abandoned. The scanty literature under this heading is unconvincing that there is such a clinical entity, and I agree with Norris and Landis that the reported cases are probably cystic disease of the lungs with superimposed bronchopneumonia.

Lobar pneumonia in children is no different from lobar pneumonia in adults. It runs the same course and has the same X-ray appearances. The right upper lobe is most often affected. Central pneumonia where the consolidation remains deep and causes no physical signs is rare. A point of importance to radiologists is the fact that the maximum development of the consolidation may not have been attained until the crisis is passed. Gross glandular enlargement is not common in lobar pneumonia in children. The varying appearances with consolidation of different lobes are well known and do not require repetition.

The Complications of Pneumonia in Children.

The complications of bronchopneumonia and to a much lesser extent of lobar pneumonia in children are collapse and fluid. *Collapse* of a lower lobe is very frequent in bronchopneumonia—it occurs insidiously and often escapes clinical detection.

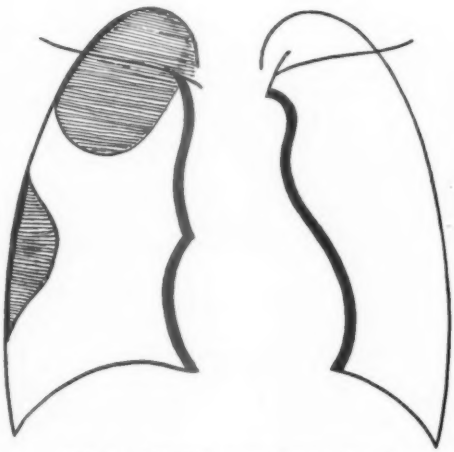

FIG. 9.—Diagram showing varieties of encysted fluid.

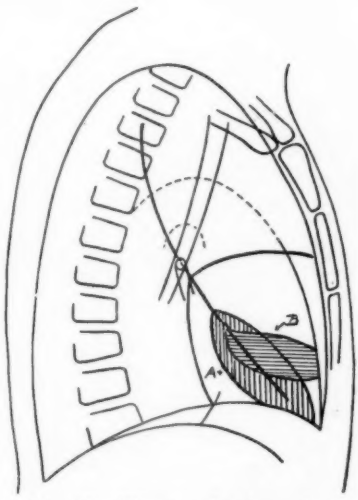

FIG. 10.—Diagram showing : A, encysted fluid resting on the diaphragm, and B, collapsed middle lobe resting on the sternum.

On a radiograph it can be detected in a moment—the fissure is visible in an abnormally low position, the lobe is opaque, and the mediastinum is displaced to the diseased side. The longer a lobe is collapsed the more difficult it is to get it reinflated again, and because of the disastrous effects which may ensue it would be a

wise procedure if every child with pneumonia were X-rayed before discharge from the hospital. There is no longer any doubt but that collapse is a factor in the causation of bronchiectasis.

Effusions, serous and purulent, are also common. It is not possible by X-rays to say whether fluid is purulent or serous, and all one can do is to locate the collection. As already described mediastinal effusions are frequent in young children. In older children the ordinary axillary type of effusion is more often seen, but occasionally there occurs what is known as a lamellar effusion—a thin pleural line is seen running up the outer border of the chest wall. Both the name and the appearances rather suggest that there is only a thin layer of fluid present—this is not so and I had a rude surprise when a pint of pus was withdrawn from a child's chest with these appearances. Spence, of Newcastle, informs me that encysted and interlobar collections are quite frequent in infants. I have only seen one interlobar empyema

FIG. 11.—Lateral view in a case of unresolved lobar pneumonia. The dense opacity and outline of the collapsed lower lobe are clearly visible.

FIG. 12.—Lateral view of an encysted empyema.

in an infant aged 5 months. The localization of interlobar collections can only be made on good lateral views. The appearance is the same as in adults—a spindle-shaped opacity with sharply defined edges lying in the line of the fissure, which is visible often throughout its full length. If the base of the opacity does not rest on the diaphragm differential diagnosis from middle lobe consolidation may be impossible. A pseudo-spindle-shaped opacity is sometimes seen in lateral views when the diaphragm on one side is raised. This opacity is produced by an overlap of heart and diaphragmatic shadows. It looks remarkably like encysted fluid but the fact that it lies entirely below the diaphragm is the decisive diagnostic point. Encysted axillary and apical collections are easily identified by a sharp convex border. Not infrequently collapse and fluid are seen together in bronchopneumonia.

Pseudo-cavities due to acute vesicular emphysema occur in both lobar and bronchopneumonia ; and we should be very chary of diagnosing cavitation in a young child

unless there is abundant evidence in other parts of the lungs or in the clinical history to support it.

Complications of Lobar Pneumonia in Adults.

There is no material difference between the clinical course and pathology of lobar pneumonia in children and adults, but the incidence of the complications is very different. In children collapse is frequent following bronchopneumonia but unusual following lobar pneumonia. In adults the reverse occurs, although we must take into account that bronchopneumonia is rare in adults. Davies, Hodgson and Whitby have shown that collapse is a fairly frequent occurrence in lobar pneumonia, but in their series of cases this did not appear to be an important factor in delayed resolution, nor is it mentioned as an important factor in the textbooks. Yet in my experience of portable radiography in cases of delayed resolution, massive collapse of a lobe is more common than any other complication. It is a fact that delay in resolution

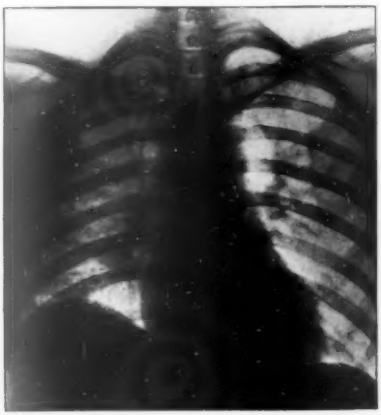

FIG. 13.—Unresolved pneumonia with small encysted axillary effusion. Note the bulging of the interspaces over the fluid.

occurs more often in people with a previous chest ailment such as bronchitis or asthma, but I have seen massive collapse just as often in young individuals with no history of previous chest disease. The lower lobe is most often affected and the radiological signs are easy to identify although the extreme degrees of deflation such as occur in children are unusual. The base of the affected lung is densely opaque and even on hard pictures it is impossible to detect vascular markings. The heart is displaced to the affected side, and if the diaphragmatic position can be detected it is raised. The intercostal spaces are contracted and in the lateral view the boundaries of the affected lobe are easily delimited. A tenacious mucus plug is the cause of the collapse and adults appear to be able to expel such a plug much easier than children.

Some kind of pleural reaction takes place in most cases of lobar pneumonia—this may be just a thin fibrinous pleuritis or a serous effusion of no great consequence or an empyema. The empyemata have the well-known radiological appearances of fluid in the pleural cavity, but they tend to occur in odd situations and are therefore easily overlooked. The pleural edge in pneumonia is best seen on hard pictures and also the widening of the intercostal spaces in the vicinity of the fluid. These are

the two vital points in the radiological diagnosis of fluid. Displacement of the mediastinum is seldom seen for when an empyema complicates pneumonia there is delay in resolution and the effect of the consolidation counteracts the effect of the fluid. On several occasions I have seen fluid and collapse associated. Even the most skilful radiologist will find himself unable to make a precise diagnosis in some of these difficult cases, and yet it is quite a frequent occurrence for a general practitioner to interpret radiographs taken for him by a layman and plunge boldly into solid lung. If that lung happens to be suppurating the result is disastrous Rarely an empyema displaces the œsophagus and causes dysphagia. In the only case which came under my observation a bougie was pushed down the œsophagus before any X-rays were taken. The patient then complained of vomiting pus, and X-rays showed a typical encysted empyema. Despite an œsophago-pleural fistula the patient recovered.

During the last few years a number of workers have reported the presence of cavities or pseudo-cavities in patients with lobar pneumonia. Ring shadows are seen

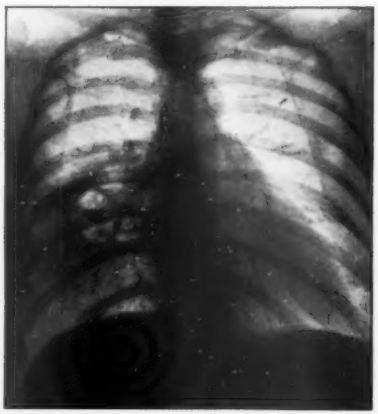

FIG. 14.—Unresolved pneumonia of the right lower lobe with pseudo-cavities.

FIG. 15.—Same patient fourteen days later.

which look like abscess cavities and which may or may not show a fluid level. These rings have been described by American authors as areas of aseptic or aputrid necrosis because they lack the characteristic odour of abscess and the patient gets well. Rabin (1936) postulates an arteritis with thrombosis and subsequent infarction in the centre of the pneumonic area. To quote this author, "the infarct in the inflamed lung is soon liquefied by enzymes from the disentegrated white blood cells in the pneumonic exudate". This is a facile but unlikely explanation. We must remember that these ring shadows are a purely radiological discovery. They cause no clinical symptoms and they have not been detected post mortem. I have carefully examined radiologically 18 cases of true pulmonary infarction and in none of them was there a suggestion of a ring shadow. I have seen these ring shadows in pneumonia in adults only when there was delayed resolution due to collapse of a large segment or of a lobe. Emphysema is the natural reaction to collapse, and there is no reason at all why overdistended lobules should not contain fluid levels.

True lung abscess complicating pneumonia is rare and the patient is desperately ill, and indeed usually dies. I have seen only two cases—in one the abscess could not be localized because the whole right lung was solid, and in the other the abscess developed in the apparently healthy lung and within twenty-four hours of its discovery ruptured into the pleura and killed the patient.

Influenzal Pneumonia.

True bronchopneumonia in adults occurs as a terminal complication of fatal diseases, and radiological examination is superfluous. There is, however, a large group of so-called influenzal pneumonias which occur in winter epidemics. Unfortunately we have no reliable X-ray records of the great epidemic of 1918-19. In the less severe epidemics of recent years the usual condition is a mild bronchopneumonia, often unilateral. A complete lobar consolidation is unusual, and the common X-ray appearances are an area of intense hyperæmia with small pea-sized foci of

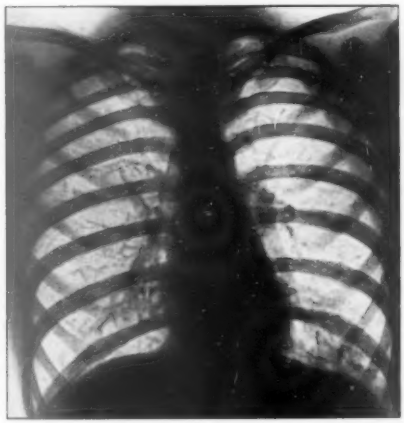

FIG. 16.—Influenzal bronchopneumonia, left base. Epidemic 1936–37.

consolidation not tending to coalesce. Resolution either takes place very quickly or is delayed for as long as six to eight weeks before the temperature settles and the lung appears normal. In the epidemic of 1936-37 I saw about 40 cases of this type and curiously enough the left base was affected three times more often than the right. All recovered except one young woman who got massive consolidation of both bases and a bilateral empyema. This high recovery rate is interesting because as a rule the radiologist sees only the worst cases, yet in this epidemic the national mortality rate was as much as 1,500 a week. The severer cases of influenzal pneumonia get large patchy areas of consolidation which may affect all lobes or only the bases, but which again do not tend to produce complete lobar consolidation. Cyanosis and intense toxæmia develop rapidly. A true miliary streptococcal pneumonia, lent me by Dr. Graham Hodgson from his series, is probably similar to the appearances which one would have found in the 1918 epidemic. This picture is indistinguishable from silicosis but can be separated from miliary tuberculosis because the foci are craggy and irregular and their distribution is uneven.

FIG. 17.—Acute serous interlobar effusion associated with influenzal pneumonia. History of influenzal cold for ten days, then rigors and a temperature of 104–105° F.; no cough or sputum; leucocytosis of 30,000.

FIG. 18.—Lateral view of fig. 17 showing fluid bulging the fissure.

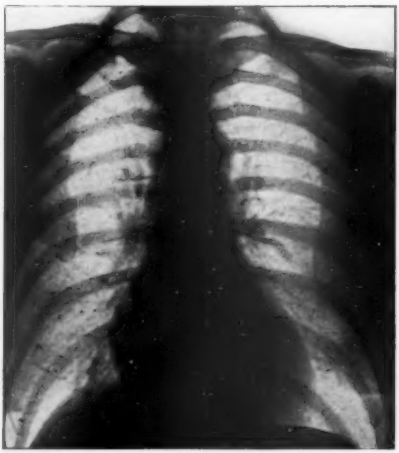

FIG. 19.—Same patient seven days later. Temperature became normal after four days.

FIG. 20.—Lateral view of fig. 19 after seven days. There is now only a little thickening at the end of the fissure. The shadow below the diaphragm is a combination shadow of heart and liver.

Collapse and Infarction.

The radiologist is being asked more and more frequently to examine post-operative chest complications. These complications are collapse and infarction. Clinically infarction due to embolism is classical with acute pain in the chest and collapse; hæmorrhage occurs twenty-four hours or so later. Infarction, however, due to thrombosis is fairly frequent and may cause symptoms similar to collapse. The

FIG. 21.—Miliary bronchopneumonia in a man aged 43. Fatal termination.

FIG. 22.—Post-operative collapse of the right lower lobe.

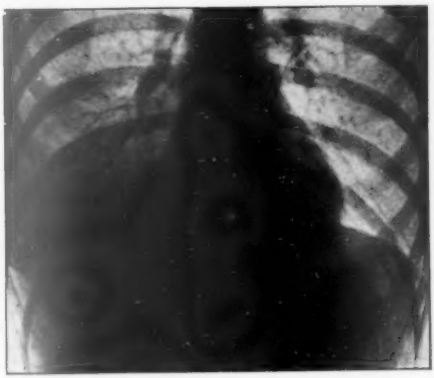

FIG. 23.—Pulmonary infarct at the right base. Note the density of the thrombosed vessel and its branches.

pulmonary thrombosis may precede thrombosis in the legs and in some cases the legs are never affected at all. As the treatment of collapse and thrombosis is quite different a precise diagnosis is important. In both diseases the patient complains of a dull ache in the chest, there is an irritating cough and moderate fever. Bleeding

usually but not always follows thrombosis, and streaks of blood may be present in the sputum in cases of collapse. In infarction, unlike collapse, the affected area is not homogeneously dense—there is no well-defined margin and clear thick vascular markings are very obvious. On looking over a number of radiographs of thrombosis this clarity and density of the vessels were very striking, and in individual cases where the pictures had been taken in different phases of respiration it was curious that the vessels in the affected area did not change at all. A glance at a post-mortem specimen revealed the obvious fact that the thrombosed vessel is radiologically visible. The fluid contents of the blood have been removed and the solid contents remain in a vessel which is completely immobile. Moreover, the thickest part of the vessel lies at the apex of the infarct where it stands out in striking relief to local normal lung tissue. In big infarcts, therefore, it is possible to identify the thrombosed vessel.

Pulmonary Suppuration.

The usual forms of lung suppuration are seldom acute in the initial stages and repetition of their X-ray appearances is unnecessary. The worst cases are those which appear to be doing quite well and then suddenly deteriorate with wide extension

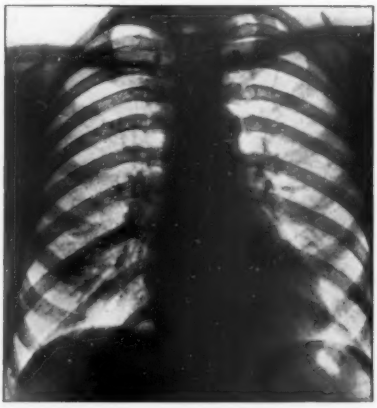

FIG. 24.—Lung abscess of the right upper lobe. Apparently normal radiograph.

FIG. 25.—Tomograph of fig. 24 showing small residual cavity in the right upper lobe. Postural drainage following this examination resulted in the expectoration of some foul-smelling pus.

of the suppurating area. A few recent observations in cases of this type suggest that (*a*) there was more than one abscess cavity present *ab initio* although X-rays may have shown only one, or (*b*) an abscess cavity may still be present although clinical and radiographic signs indicate complete healing. Tomography is superior to all other methods of investigation in lung suppuration. Not only does it reveal the primary cavity and its position but it also shows up the site and calibre of drainage bronchi and the presence of unsuspected pockets. It also explains these unfortunate cases of recurrence which have apparently healed and show normal radiographs.

Pulmonary Hæmorrhage.

Severe pulmonary hæmorrhage is usually caused by tuberculosis, dry bronchiectasis, neoplasms or certain cardiac diseases. Occasionally cases occur which are inexplicable. The chief point for the radiologist is to be able to identify the blood in the lungs as such. Inhaled blood is spattered into the alveoli exactly like lipiodol. Although it cannot be visualized in the bronchi because it does not stick to the walls, it distributes itself in the lung segments and alveoli like lipiodol. An examination with a lens shows multiple small soft spots arranged in rosette pattern. It is difficult to describe but it looks exactly like old lipiodol which has been in the lungs for some months and is incompletely absorbed. Fig. 26 is a very good example. The patient was a young woman suffering for ten days from so-called gastric influenza, with vomiting and diarrhœa and a temperature of 100°. She suddenly got a violent attack of coughing and brought up a large quantity of frothy bright red blood. Although her story suggested that it might have been an hæmatemesis, her chest was X-rayed and showed the typical appearances of inhaled blood in both lungs. There

FIG. 26.—Inhaled blood in both lungs. Ætiology of hæmorrhage unknown.

was no gross lung lesion visible to account for the bleeding. Pictures a week after the hæmorrhage showed most of the blood to have disappeared. The patient's temperature became normal, she improved during a fortnight at the sea, then returned feeling rather ill got a mild bilateral pyelitis and died without any localizing lesion than the pyelitis. Her blood-count never showed anything but a mild secondary anæmia.

In another case an elderly man coughed up fresh blood and X-ray examination showed massive collapse of the left lung. A week later he coughed up what he himself described as a piece of thick red stuff, and another picture showed a completely normal left lung. Apart from the bleeding he was symptomless and in perfect health. Unfortunately I have been unable to get further data about this patient and one can only suspect that there was a small neoplastic ulcer present, in a large bronchus.

Acute Lesions of the Bony Thorax.

On two occasions I have seen lesions of the bony thorax simulating acute chest conditions. One was in a middle-aged man with a small bronchopneumonic patch at the left base. He had high fever and a leucocytosis of about 18,000.

A few days later an abscess pointed over his 7th left rib. Lipiodol injection of the subsequent small sinus showed the track leading to the anterior end of the rib. The pleura and lung were never affected. The second case was a small boy whom I saw with Dr. Coldwell. He had fever, a sharp leucocytosis, but was otherwise symptomless and could only with difficulty be kept in bed. His original chest picture (fig. 27), coupled with the history made one think of the possibility of bilateral mediastinal empyema, but the inward curve of the right lower opacity which sweeps into the spinal shadow well below the root of the lung is more suggestive of a paravertebral abscess. This was the correct diagnosis, but it was not for another two months that necrosis of the body of the 11th dorsal vertebra was visualized. At no period

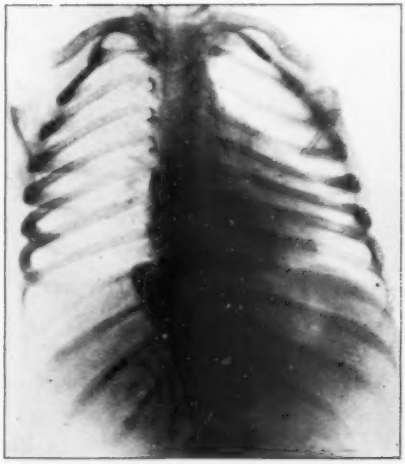

FIG. 27.—Paravertebral abscess simulating mediastinal effusion.

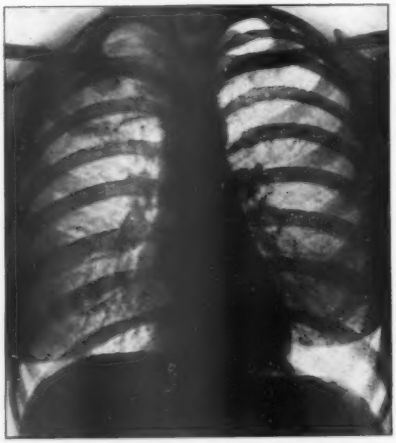

FIG. 28.—Erosion of the posterior part of the 3rd right rib complicating right upper lobe pneumonia.

was there pain, deformity, or loss of mobility. The child is now doing quite well in a plaster jacket.

My last case may be unique or may be a common occurrence which has been overlooked. The patient was a girl aged 23 who had right upper lobar pneumonia resolving by crisis. During the acute stage she complained of severe pain over the posterior part of the lobe. This persisted after her recovery and she was referred to the chest hospital. There was nothing to be seen externally and no physical signs of consequence in her lungs. The X-rays showed a residual hyperæmia in the right upper lobe, the usual thing after lobar pneumonia, and an extensive erosion of the posterior part of the 3rd right rib. She was quite well except for her pain, and after a few weeks this gradually disappeared with recalcification of the rib. It is impossible to find any reasonable explanation of the pathology in this case. It can hardly have been fortuitous that the affected rib coincided with the area of pulmonary consolidation.

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Discussion.—Dr. F. G. CHANDLER: Thanks to the frequent use of the portable X-ray plant in hospital and private practice, and the increased recognition of its value, our experience of acute conditions is now worth reviewing. Inflammatory areas, infarction, with their distribution, partial pneumothoraces, massive collapse, interlobar effusions, deep-seated abscesses, focal atelectasis, and many other conditions are revealed by radiography. By the more frequent use of radiography in the acute conditions, especially where there is something atypical in the clinical course, e.g. hæmoptysis persisting after an attack of bronchopneumonia, we shall help in the earlier diagnosis of carcinoma.

There is still need for caution, however, in interpretation. The skiagraphic appearances must be correlated with the clinical aspects of the case, and the microscopy of the sputum—not that clinical observation or microscopy is less liable to misinterpretation, particularly in the question of carcinoma of the bronchus, which may simulate acute conditions such as massive collapse, abscess, pneumonia, or be simulated by them.

To-day, when carcinoma of the bronchus is so common, this difficulty frequently arises in private practice, for it is here that the complete and often complicated investigations that may be needed for a differential diagnosis are often most difficult to carry out.

I have recently seen four cases of acute febrile conditions where the diagnosis was in doubt; they might be labelled severally pleural effusion, atelectasis, bronchiectasis, pneumonia with a sudden shift of the mediastinum to the affected side, yet in each there was a strong suspicion of a carcinoma as the basic cause. Radiography has not been able to settle the question. A sudden shift of the mediastinum to the side of the lesion, a heart displaced towards an effusion, ought to mean bronchial occlusion, but when we come to the nature of the occlusion our difficulties begin. We must be careful too with regard to this question of displacement, especially of the trachea. A slight distortion may lead to error; an apparent displacement of the mediastinum may be illusory and falsify the diagnosis.

This brings me to my last point, the method of X-raying a very sick patient, which may be a surprisingly exhausting procedure. The picture should be taken with the patient comfortably propped up by pillows in the half-recumbent position—this will allow of fluid levels. He must be lying absolutely square with arms and legs absolutely symmetrical. The casette should then be slipped behind the patient and the tube orientated appropriately. This gives a posterior view, whereas we would rather have an anterior, but it is so much more easy for the patient, that we may have to be content with that. The next is the true lateral view, the film, of course, applied to the affected side, the patient again half recumbent only. This is much more difficult for all concerned, but it is often an essential piece of evidence and must be aimed at. Oblique views, in my experience, are of limited value in the acute conditions.

Dr. E. W. TWINING agreed with Dr. Kerley that the clearly defined paravertebral shadow which he had found in the chests of children was due to effusion and not to paravertebral pneumonia, and was interested to learn that mediastinal effusion—rare in adults in his own experience—was apparently less rare in children.

The differential diagnosis between interlobar effusion in the main fissure, and collapse and consolidation of the middle lobe, was evidently very difficult. The speaker agreed with Dr. Kerley's differential criteria except one, namely the relation of the base of the shadow to the diaphragm and chest wall respectively; even though the middle lobe consolidation usually had its base against the anterior chest wall, while the effusion was usually found further back, with its lower end in relation to the diaphragm, this relation might be altered by compensatory overinflation of the other lobes, so that the middle lobe might be pushed back into contact with the diaphragm by overinflation of the upper lobe, or an effusion might be pushed forward into contact with the chest wall by an overinflated lower lobe.

He asked Dr. Kerley for further observations on his conception of the nature of intrapulmonary vesicular emphysema. One of Dr. Kerley's cases had shown a transient overdistended area with free fluid level. He asked whether this was not actually a cavity, for it would appear that if it were really a vesicular emphysema, that is an area occupied by a sponge-work of emphysematous alveoli, a free fluid level could hardly occur. It might occur, however, if the alveolar walls were completely broken down. These intrapulmonary "air cysts" were interesting, and their pathology often obscure. It was not even certain, in some cases, whether they were caused by local overinflation or, as suggested by Laurell [1], due to elastic traction of the lung enlarging a

small tear or cavity in the pulmonary tissue. Peirce and Dirkse [2] who had met with cases of such intrapulmonary " pneumatoceles " in the course of acute bronchopneumonia, apparently favoured the overinflation (or " check-valve " theory) and think that these lesions, if persistent, may account for many cases diagnosed as congenital cysts.

Dr. Chandler had questioned the value of oblique views in portable chest work. Dr. Twining pointed out that the full lateral view, though essential as a routine measure, was sometimes disappointing. The essential thing in the adequate examination of an " acute " chest was a thorough screen examination by an experienced observer, and oblique views, often at quite unorthodox angles, guided by expert screen examination, might be of decisive importance, even though routine views failed to make the diagnosis.

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Section of Therapeutics and Pharmacology

President—J. W. Trevan, M.B.

[*January* 10, 1939]

DISCUSSION ON THE CLINICAL ASPECTS OF THE VITAMIN-B COMPLEX

Professor R. A. Peters: Up to the present time seven entities have been described in the vitamin-B complex [1]. It is not yet certain that there are seven different chemical substances, but there are almost certainly five. Only two of these, vitamin B_1 (also known as aneurin or thiamin) and nicotinic acid (the antipellagra factor) are important in the nutrition of man, though it is unlikely that lactoflavin is not also important, because it forms part of a tissue respiration system. The other parts of the complex are known at present only as animal factors. In the nutrition of the growing animal, deficiency of a factor soon makes itself felt by failure to grow. With the adult it must always be remembered that a deficiency only shows up when a factor is easily lost; the more tenaciously any vitamin is held by the body, the less will it be likely to be a serious element in causing gross pathological change. It is for instance hard to deprive an adult rat of lactoflavin sufficiently to cause symptoms, though the young rat cannot grow without a substantial addition to the daily diet.

The most important vitamin in the group as well as the earliest to be properly defined is vitamin B_1; the constitution of this we now know even by synthesis [1], and the amounts available make work upon the clinical and physiological sides more possible. For the earlier literature dealing with this vitamin, the reader is referred to an earlier paper [2], and to the book by Williams and Spies [3], and for later references to the *Annual Review of Biochemistry*. There is now little doubt that most if not all living cells require this factor; some bacteria will not grow without it, and others which grow well in its absence synthesize it. Its function in the metabolism of yeast is of the greatest interest, because there is reason to believe that without it we could not have wine or alcoholic drink. It has been known for a long time that an essential stage in the production of alcohol from sugar was the conversion of pyruvic acid ($CH_3COCOOH$) to acetaldehyde (CH_3CHO) and CO_2, and that this was carried out by a special enzyme carboxylase (Neuberg [1]); a co-enzyme is necessary for this change called co-carboxylase (Auhagen [1]), which was lately shown to be vitamin B_1 pyrophosphate by Lohmann and Schuster [4]. This is therefore essential in the production of the acetaldehyde which is subsequently converted to alcohol by reduction. It may be noted that, even in this low form of life, the vitamin is concerned with a stage in carbohydrate metabolism, because the pyruvic acid is an intermediary in sugar degradation.

In recent years, work which preceded the above discovery in yeast has shown that vitamin B_1 is also concerned with carbohydrate metabolism in the higher organism. Before proceeding to a description of the more recent work on this problem, some general remarks are necessary upon carbohydrate metabolism to clear the point at issue. In the higher animal there are two rather distinct phases of the sugar metabolism, that of the individual cells and that of the body as a whole. We can induce changes in the blood-sugar level (alteration in tolerance, &c.), without changing appreciably the details of the breakdown of sugar in the cells of individual tissues. On the other hand, we can imagine that there might be conditions in which locally the sugar metabolism of an individual tissue might be at fault without much effect upon the blood-sugar level. If it happened that the normal functioning of tissue cells whose metabolism of sugar was upset, was an important condition in the control of

some feature of the general sugar metabolism as reflected in the blood-sugar level, then we might expect that disturbance of the tissue sugar metabolism would cause as a secondary effect derangement of blood-sugar levels. The extent of such an upset would depend of course upon the degree to which the individual cell relied for its proper functioning upon carbohydrate rather than fat. If a vitamin therefore affects the sugar metabolism of any body cell, in theory two things may happen ; not only may the cell itself be deranged in its metabolism, but also through failure to carry out its proper integrated function in the body as a whole, there may arise general changes in carbohydrate metabolism. The principle is an important general one of wide application. In the case of vitamin-B_1 deficiency, the organs to suffer seriously in metabolism from lack of vitamin B_1 are the brain and nervous tissues, the heart, and the kidney. I believe that owing to the dysfunction of lower parts of the brain, certain other disturbances take place in the general sugar metabolism as a secondary problem. The symptoms which manifest themselves in man in beri-beri are well known clinically. In animals, we find an initial anorexia, not only characteristic of this vitamin, but also of others ; loss of weight, unless there is artificial feeding, the appearance of certain symptoms of a nervous type, sometimes œdema (increased by salt feeding) ; there may also appear changes in sugar tolerance in the terminal stages as well as abnormal body temperature.

There is now proof that there is a fault induced in the sugar metabolism of the brain by lack of vitamin B_1 in the tissue. The main points in this proof may now be given ; they supplement those described in 1934 to the Section of Tropical Medicine.

Avitaminous brain tissue from a pigeon suffering from symptoms of opisthotonos is removed and mashed, and subsequently introduced into apparatus for measuring respiration *in vitro* in a suitable Ringer-phosphate medium containing lactate as substrate. Lactate is an intermediary in the sugar metabolism of this system, because such brain tissue rapidly splits down glucose into lactic acid by the process of glycolysis, which is outside the scope of this discussion. After a suitable time at 38° C. it is found that pyruvate is present in the respiration bottles [5]. This has been formed from lactate by an oxidative reaction. If vitamin B_1 is added, there is practically no pyruvate formed, but at the same time the respiration is increased ; very small amounts of vitamin B_1 (0·2 γ per c.c. $\gamma = 0{\cdot}001$ mgm.) sufficing for producing a maximum change. We can write therefore the following equation :—

$$\text{Lactate} + 0 \rightarrow \text{Pyruvate} + (\text{n})\ 0 \rightarrow CO_2 + H_2O + \text{other oxidation products.}$$

$$\uparrow$$

$$\text{Vitamin } B_1$$

It can be shown in several ways that it is only the pyruvate system that is affected. One of the best methods is to use a substrate for the brain enzymes not belonging to the carbohydrate series, such as succinate, when there is found to be no change as the result of adding vitamin. An important point is that normal tissue shows practically no formation of pyruvate and no effect of added vitamin. In several experiments of this type, the conclusion has been reached that the brain tissue itself is deficient in vitamin B_1, and that this failure causes a fault in the sugar metabolism at the pyruvate stage. One particularly important point in the proof that these *in vitro* effects are not artificial is the existence of pyruvate in the blood from avitaminous animals. This was discovered first by Thompson in the blood of avitaminous pigeons and rats (Thompson and Johnson [7]), and has been ably extended to human cases of beri-beri by Platt and Lu [8]. It is probable that other abnormal substances are present and in some diseases of children methyl glyoxal has been described [9], but I believe that these are in some way secondary to the fault in pyruvic acid. Though the pyruvate in blood is associated strictly with the avitaminous condition, its extent does not correspond exactly with the symptoms, which are due to a fault in the cell machinery. It is an error to think that the pyruvic acid is a toxic agent. It is interesting to note

that the discovery of pyruvic acid in the blood of human beri-beri arose from the original observation carried out upon pigeons' brain tissue *in vitro* for quite theoretical reasons.

So in the higher animals we find vitamin B_1 also concerned with the metabolism of the pyruvic acid molecule, but as often happens in Nature, there are important differences in detail. Unlike yeast, no CO_2 formation takes place without oxidation, and no formation of acetaldehyde. The object seems to be to get the maximum amount of energy out of the compound, and at the same time to avoid the formation of the highly reactive substance acetaldehyde, which might be dangerous to the higher organism.

Some detailed investigations in Oxford and elsewhere have been made of the oxidation products of pyruvic acid by brain tissue. McGowan [10] in particular has shown that the pyruvic acid is not completely burnt. Part escaping complete combustion has been found by Long [11] to give rise to acetic acid, which is not further oxidized by brain tissue. Both these are aerobic reactions. Anaerobically another reaction has been realized by Krebs and Johnson [12], namely the simultaneous formation of lactic acid, acetic acid, and CO_2. Though a balance sheet can now be constructed *in vitro*, it is not certain in the living brain what proportion of each of these pyruvic acid reactions takes place, but it is probable that Nature has several alternative methods of obtaining energy for its essential reactions from this carbohydrate intermediate, of which direct oxidation yields the most energy.

The problem which we and others have tried to tackle lately has been whether the vitamin present in the brain is diphosphorylated as suggested by Lohmann and Schuster from their yeast work. At present the provisional view has been reached that in brain as in yeast the active form of vitamin B_1 is so phosphorylated. Some of the evidence for this is as follows: During the presymptom condition in pigeons fed upon polished rice diet, there is a large decrease in the co-carboxylase[1] normally present in the brain tissue.

A further decrease takes place in animals showing symptoms, and when these symptoms have improved there is found an increase. At the same time there is little free vitamin B_1 in the brain itself. Again it can be proved that liver rapidly synthesizes co-carboxylase from vitamin B_1 administered by the mouth or by injection; these results obtained by Dr. Ochoa and myself [13] have been reached using an enzymic method of estimation, made possible by the discovery by Ochoa that vitamin B_1 stimulates CO_2 production of co-carboxylase from yeast. They have been confirmed by a quite different method by Westenbrink and Goudsmit [14], in which they have shown also that the kidney has synthetic powers. Upon the question as to the form in which vitamin B_1 is transported in blood we leave Mr. Sinclair to describe results of his recent work. *In vitro* brain tissue has a poor capacity for synthesis of the phosphoric esters as compared with liver. This story is now complete except in one detail. Vitamin B_1 has a much better catatorulin effect (i.e. *in vitro*) than its pyrophosphoric ester. It is not yet known whether this is fundamental or merely some accident of permeability.

Considered as a whole the evidence for vitamin-B_1 connexion with an intimate detail in sugar metabolism of the cell is conclusive. It is not certain whether the large amounts of pyruvic acid found in the blood of the beri-beri patient can all come from the nervous system. Platt and Lu think that there must be some other source, but it seems significant that the brain tissue which depends almost entirely upon carbohydrate for its metabolism should suffer worst by lack of an important catalyst in this system. Roughly speaking, the tissues most continuously at work, heart, lower parts of brain and kidneys, suffer most quickly from a failure of vitamin.

Presumably there is some loss of the molecule during active work. The primary problem therefore in assessing the avitaminous condition in an animal is to decide

[1] Assumed to be vitamin-B_1 pyrophosphate.

which tissues most rapidly become sufficiently deficient in the factor to be pathological. This stage for a given tissue can never be reached until the stores in other parts of the body are depleted or until other tissues can no longer liberate in some way sufficient traces of the vitamin for more essential tissues. There must always be a preliminary period during which the deficiency remains latent in the adult, though in this state it is likely to show up by a diminution in the weight of the body. It is clear that failure of essential cells in the brain concerned in the endocrine regulation of blood-sugar can hardly fail to produce changes in the general carbohydrate metabolism. This I believe to be the explanation of some of the terminal changes in sugar tolerance, and of the large increases of glycogen sometimes observed in the liver [15]. In any case the most sensible and fruitful theory is that the changes in general carbohydrate metabolism are secondary to the primary disturbance in the intermediary carbohydrate metabolism of the cells of certain tissues. From the above it will be clear that the clinical conditions likely to lie in the realm of vitamin-B_1 deficiency will have as their initial focus the tissues which I have mentioned (namely brain and nervous system, heart and kidney). Unfortunately it is impossible to remove the pieces of tissue in man for investigation, much as we might like as scientists to do so ! We are therefore limited to observations upon the blood and to the attempt to decide in given groups of cases whether vitamin B_1 has had a curative effect. We must consider that in all cases (and this includes fever as well as pregnancy) where there is a raised metabolism and an increased consumption of carbohydrate food, automatically more vitamin B_1 is required. Unless the carbohydrate food contains this vitamin there is distinct danger of slight deficiency. This deficiency may be definitely accentuated by changed endocrinal conditions. The best example of this which I know is hyperthyroidism in rats. Barnet Sure and Buchanan [16] have found that large doses of vitamin B_1 prevent to some extent the fall in weight of young rats injected with thyroxin, and lately Drill and Sherwood [17] find that a similar phenomenon is true for the adult rats. In preliminary as yet unpublished results which confirm and slightly extend these, Mr. Rossiter and I can say that adult rats fed upon normal doses of vitamin B_1 given in the diet nevertheless require additional doses of vitamin B_1 to protect against the fall in weight produced by thyroid feeding, and may even show a deficiency of the vitamin in kidney and brain by the catatorulin test ; in rat-brain it is even difficult to show these effects by vitamin B_1 deficiency. Such animals are therefore, by thyroid feeding, changed into animals having an idiosyncrasy for more vitamin B_1. If this can happen so clearly in the case of one endocrine disturbance, it should open our eyes to the possibility that other similar disturbances may be at work with other factors. In any case such knowledge must upset any complacent feeling we may have that an average mixed diet is sufficient for all individuals. Now that there are some methods available for computing the vitamin-B_1 content of diets, there is little excuse for not making an inquiry into the diet as a routine examination.

Much is talked of preventive medicine. It is very probable that early heart strain might be avoided by preventing temporary slight vitamin deficiency.

The relation of vitamin B_1 to the carbohydrate metabolism has been the burden of this communication. Carbohydrate metabolism is ultimately closely linked with the metabolism of fat, and in fact fat is well known to be formed from carbohydrate. We might expect therefore that a failure of fat synthesis will take place with a deranged carbohydrate metabolism, though it might be that earlier stages in the degradation of sugar than pyruvic acid will be needed for fat synthesis. Some results by McHenry and colleagues [19] show that in animals vitamin B_1 administration leads to a rapid synthesis of fat. This suggests that degradation of pyruvic acid by vitamin B_1 is an essential element in such fat synthesis. To this extent vitamin B_1 may be said to be responsible for fat metabolism, but I think it a wrong interpretation if more than this is claimed. Another aspect of the subject which is really different is that of the

sparing action of fat upon the utilization of vitamin B_1 [20]. This has been now proved satisfactorily from several researches, so that it can be assumed that fat in the diet lessens the demand for vitamin B_1. It is my opinion that the correct interpretation of such experiments lies in the realization that the breakdown of fat to provide energy in these cases is carried through in the main without transformation to carbohydrate so that the use of vitamin B_1 or its compounds as a catalyst is not necessary. At present there exists no evidence that vitamin B_1 is concerned in the higher animal with any other compound than pyruvic acid.

APPENDIX (with R. J. Rossiter).—Fig. 1 shows the effect of vitamin B_1 upon a rat feeding *ad libitum* upon a full mixed diet + desiccated thyroid (0·4 mgm./diem). The rise of weight is sensational; in this case it was above the initial weight. Fig. 2

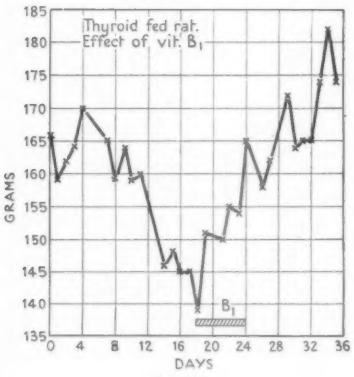

FIG. 1.

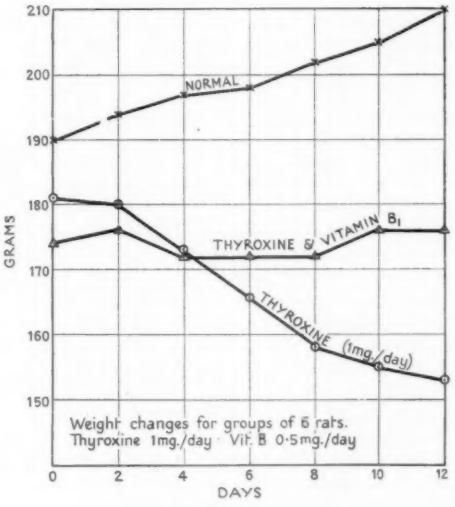

FIG. 2.

gives a comparison of the weights of groups of six rats, normal, thyroxine injected (1 mgm./diem) and the same + vitamin B_1 (0·5 mgm./diem). The difference in behaviour is again very marked. It is significant to note that any increased metabolism compensated by increased food consumption should have been fully corrected by the vitamin B_1 already in the diet.

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Dr. H. M. Sinclair: *The causes of deficiency of vitamin B_1.*—The extent to which deficiency of vitamin B_1 occurs in this country is not known. Gross deficiency is doubtless very rare, but there is an increasing amount of evidence that mild deficiency is much more common than is generally supposed. Some authorities doubt this: according to Hutchison and Mottram (1936), "few, if any of us, lack" vitamin B_1; Aykroyd (1936) believes "there is really little reason to believe that the average English or American dietary . . . contains insufficient vitamin B_1 for health". Other authorities believe that mild deficiency is common: an Editorial in the *British Medical Journal* (October 16, 1937) stated that "there is therefore good reason to regard vitamin-B_1 deficiency as an outstanding fault in the diets of many millions of people in this country"; and according to Strauss (1938) beri-beri is endemic in the United States. The object of this communication is to show that deficiency can arise from factors other than a faulty diet.

In a Discussion held at this Section exactly nine years ago, the opening speaker, Major-General Megaw, believed that a deficiency of vitamin B_1 was not responsible for the ill-effects usually attributed to it, and stated that beri-beri was probably mainly caused by an intoxication due particularly to a poison in rice that had been stored in hot and damp places (Megaw, 1930). In the nine years since that discussion very rapid advances have been made in the physiology of vitamin B_1. Starting in 1929 with the observation that there is an abnormally large amount of lactic acid in the blood of pigeons with opisthotonos due to deficiency of vitamin B_1, Peters has proved that the vitamin is a catalyst, or part of a catalyst, that is concerned with the oxidation of pyruvic acid. In its absence the oxidation of carbohydrate is arrested at the stage of pyruvic acid; and this fault in metabolism, which occurs particularly in nerve cells, heart, and kidney, is probably responsible for the symptoms and signs of polyneuritis in lower animals and beri-beri in man. The second important contribution has been made by Cowgill, who showed that an animal's requirement of vitamin B_1 was proportional to the body-weight and total metabolism or calories. This, as will be shown below, has proved very useful in understanding the incidence of beri-beri. The third contribution of great importance was the synthesis of the vitamin by Williams and others in 1936. This not only established the chemical formula of the compound, but has also made the pure vitamin readily available for therapeutic purposes.

This and other work done upon lower animals has advanced much more rapidly than work upon deficiency of vitamin B_1 in man. A very large literature upon the latter subject has grown up in recent years, but it has proved disappointingly little because the work has generally been uncritical and uncontrolled. The laboratory worker is surprised when he reads reports of the efficacy of vitamin B_1 in the treatment of such diverse conditions as varicose veins, lead neuritis, subacute combined degeneration of the cord, disseminated sclerosis, anterior poliomyelitis, Korsakov's psychosis, sciatica, and in the induction of labour. His surprise turns to annoyance when he reads these papers and finds that the claim is not proved, for the exhibition of the vitamin has not been the only form of therapy and the remarkable ability of many patients (for instance, cases of disseminated sclerosis or of Korsakov's psychosis) to improve despite the interference of the clinician has been forgotten. To show that a condition is due to a deficiency of vitamin B_1 it is desirable to show how such a deficiency could have arisen and that it responds to therapy with vitamin B_1 alone;

it is preferable also to show that *at the time when the symptoms and signs are developing* there is an abnormally small amount of the vitamin in the blood or the urine. Deficiency may arise owing to several factors which will be mentioned presently, and it is not sufficient merely to calculate the vitamin/calorie ratio. Response to therapy or failure thereof is apt to be misleading unless certain points are borne in mind. It is in the early and acute stages that response will be most dramatic, when the biochemical lesion in the metabolism of the cell is easily corrected and has not yet led to irreversible disorganization of the cell. A pigeon that is blind and opisthotonic as a result of acute deficiency of vitamin B_1 will recover completely within half an hour of the injection of the pure vitamin. In man, acute dilatation of the heart sometimes responds dramatically to therapy with the vitamin, and a copious diuresis may herald the disappearance of the œdema; but symptoms or signs caused by chronic degeneration of the neurones may be relieved little or not at all by administering the vitamin. Further, it is essential that the amount be adequate. Treatment should be started with intramuscular or intravenous injection of from 20 to 50 mgm. daily. Later the same dose may be given orally, or the injections decreased to 10 mgm. daily until the patient is completely relieved of symptoms. It is advisable to administer the vitamin by injection if there is doubt about its efficacy by mouth; for instance Badger and Patrick (1938) found little effect on the neuritis of leprosy after oral administration, but good results after intramuscular injection.

Although the proof that clinical improvement is due to the vitamin rests upon administering it while all other relevant factors are controlled, such a procedure is in practice often unjustified. Many patients with dietary deficiency suffer from lack of more than one factor; pellagra, although due to deficiency of nicotinic acid, is commonly accompanied by neuritis which is cured by vitamin B_1 but not by nicotinic acid (Spies and Aring, 1938), and some cases of scurvy have deficiency of vitamin B_1 as well. Therefore it is essential in such cases to improve the diet and to administer suitable preparations of more than one vitamin in order adequately to treat the patient.

The most satisfactory way of proving deficiency is to show that the amount of vitamin in the plasma is significantly low. Estimation of pyruvic acid in the blood has been used, but is not very helpful because the customary method is not specific; and pyruvate tolerance curves were tried in America three years ago, but were similarly abandoned. Urinary estimations by four different methods have been done by several workers, but they have not yet been extensively used clinically. Two methods are available for estimating vitamin B_1 in blood: the thiochrome method (Jansen, 1938), which has only recently been used, and Schopfer's method which rests upon the ability of a fungus, *Phycomyces blakesleeanus*, to grow only in the presence of the vitamin (or certain closely related compounds), and which has been applied to blood by Meiklejohn (1937). Meiklejohn's method has been rather uncritically used by Rowlands and Wilkinson (1938). I have been using this method, slightly modified, during the last two and a half years, and have recently shown (Sinclair, 1938*c*) that it is useful for comparative purposes, although it does not give true values for the total vitamin in blood. The results of determinations on about 200 cases were presented in June 1938 (Sinclair, 1938*b*), and a further 200 have been examined since then. In these analyses values that are significantly below the normal range have been found in some cases of the following conditions only: pregnancy accompanied by poor diet, and macrocytic anæmia of pregnancy; pernicious anæmia with myxœdema, idiopathic steatorrhœa and cœliac disease, idiopathic hypochromic anæmia; nutritional, gastrogenous, gestational and "alcoholic" polyneuritides; scurvy, carcinoma and ulcer of the stomach and after gastrectomy, fatal pulmonary tuberculosis, *anorexia nervosa*, and "beri-beri heart". Apparently normal values have been found in a variety of diseases, including subacute combined degeneration of the cord; disseminated sclerosis; toxic, infective and diabetic polyneuritides; osteomalacia, and nutritional œdema with low plasma protein.

The factors tending to produce deficiency may conveniently be summarized as follows :—

A.—Inadequate ingestion.

(1) *Unbalanced diet.*—Alcoholism, " glucose-lemonade ", gastric ulcer diets.

(2) *Increased requirement—*

High carbohydrate diet—(diabetes mellitus).

Increased metabolism { Muscular work and rapid growth. / Delirium, and manic type of manic-depressive psychosis. / Pregnancy and childbirth. / Fever. / Hyperthyroidism.

Diuresis. Lactation.

Possibly leucocytosis, and polycythæmia.

B.—Failure of assimilation.

(1) *Destruction in gut.*—Achlorhydria. Pyloric stenosis, carcinoma of stomach, gastric ulcer.

(2) *Failure of absorption.*—Diarrhœa : steatorrhœa ; ulcerative colitis ; bacillary dysentery. Gastro- and entero-enterostomy.

(3) *Failure of phosphorylation.*—Possibly steatorrhœas. Possibly diseases of liver, and of reticulo-endothelial system.

Actual deficient intake in otherwise normal people is undoubtedly rare in this country. Poor folk living on meagre diets ingest few calories and therefore, as Cowgill has shown, there is little tendency for them to develop polyneuritis. For that reason, too, polyneuritis is very rare in cases of *anorexia nervosa* and in professional fasters. But an unbalanced diet that is high in calories and low in vitamin B_1 will produce symptoms of deficiency. Cases of " alcoholic " polyneuritis afford excellent examples, because they take a diet high in calories (most of the energy being supplied by alcohol) and low in vitamin B_1 (since no form of spirits contains the vitamin). This disease, which afflicts spirit-drinkers in America but not beer-drinkers in England, has been proved to be due to deficiency of the vitamin (*see* Goodhart and Jolliffe, 1938). Analyses of blood mentioned above support this conclusion. Other unbalanced diets may produce deficiency : for instance brandy and glucose, or glucose-lemonade, for fevers and ailing infants ; diets for gastric ulcer. A case of beri-beri due to a " reducing diet " was described by Snyder (1936).

A number of factors increase the requirement of the vitamin. Since it is necessary both for the oxidation of carbohydrate and for its conversion to fat, the requirement will be proportional to the quantity of carbohydrate ingested. Three cases have been recorded of beri-beri following the ingestion of abnormally large amounts of carbohydrate. Similarly, it is well known that fat has a sparing action (Evans and Lepkovsky, 1929). Any factor that increases the metabolism of the body will increase the amount of vitamin required. Muscular work and rapid growth are two such factors and beri-beri is commonest in young adult males and breast-fed infants. But in the latter a more important factor obtains. The requirement of the vitamin in pregnancy is tripled, and during lactation it is also similarly increased. There is therefore a strong tendency for the pregnant or lactating woman to become deficient, and the breast-fed infant to follow suit. Most, but not all, of the cases of polyneuritis developing during pregnancy are probably due to deficiency of vitamin B_1 (Hofmann, 1924 ; Strauss and McDonald, 1933 ; Wu Hung Tak, 1937). Fever also raises metabolism ; the frequent association of beri-beri with prolonged fever has led some clinicians to believe that beri-beri is an infection and not a dietary deficiency. Further, vitamin B_1 is stated to be effective in post-influenzal neuritis and the neuritis of leprosy. The other main condition in which metabolism is raised is hyperthyroidism, and in this it is known that the requirement of the vitamin is increased (Cowgill and Palmieri, 1933). Various workers have shown that administration of the vitamin prevents weight loss in animals fed on thyroid (Sure and Buchanan, 1937 ; Drill and Sherwood, 1938) and also lessens thyrotoxicosis and the operative mortality

(Frazier and Ravdin, 1938 ; Schneider and Burger, 1938). Weiss believes deficiency of vitamin B_1 may explain why some patients with thyrotoxicosis have cardiac symptoms and cardiac dilatation.

Cowgill has shown that diuresis increases the requirement of vitamin B_1 (Cowgill *et al.*, 1930). Although this is commonly not an important factor, it might be of importance in diabetes mellitus, particularly if treatment with a high carbohydrate diet is employed, thereby further increasing the requirement of the vitamin. There is undoubtedly more than one form of diabetic neuritis, and there is no direct evidence that vitamin deficiency plays a part in any. However, just as the disturbance of carbohydrate metabolism in deficiency of vitamin B_1 affects nerve-cells predominantly because they oxidize mainly carbohydrate, so diabetes mellitus might cause neuritis owing to a disturbance in carbohydrate metabolism.

Finally, it is possible that both polycythæmia and leucocytosis may increase the requirement of the vitamin, and one patient in my series who had a red cell count of 6,900,000 and a white cell count of 25,500 developed peripheral neuritis of unknown ætiology, and had a very high value for the vitamin in the blood. It is known that there is practically no free vitamin B_1 in blood because it is bound probably to protein (Sinclair, 1938*a*) ; Dr. Goodhart and I have recently found that there is very little vitamin (free or bound) in plasma, and most of it is bound inside (or on) the erythrocytes and particularly the polymorphonuclear leucocytes. It is possible that the avidity of the cells of the blood for the vitamin may increase the requirement ; the matter will be further considered below.

Failure of assimilation of vitamin B_1 may be due to destruction in the gut, failure of absorption from the gut, or failure of phosphorylation. Various authors (e.g. Strauss, 1934 ; Mackie and Pound, 1935) have pointed out that gastro-intestinal dysfunction is often associated with deficiency diseases. There are many accounts of polyneuritis following carcinoma or ulcer of the stomach. In one such case that was studied recently (Laurent and Sinclair, 1938), in which polyneuritis was accompanied by a low value for vitamin B_1 in blood and was cured by relieving the pyloric stenosis, it was suggested that some factor (possibly an enzyme) produced by the stomach or duodenum might have destroyed or prevented the absorption of the vitamin in the prolonged presence of alkali. Soon afterwards, I found that incubating the vitamin with gastric or duodenal juice from patients with achlorhydria caused destruction. Mahlo (1938) has made the additional very interesting observation that the presence of hæmin causes destruction even in an acid medium. So it is now easy to understand why patients with carcinoma or ulcer of the stomach may become deficient through destruction of the vitamin, even if the secretion of hydrochloric acid by the stomach is not diminished.

Failure of absorption from the gut occurs in several conditions. Dann and Cowgill (1938) have shown experimentally that chronic diarrhœa is one such cause ; this probably explains the low blood values that I have found in some cases of steatorrhœa, and also the occurrence of beri-beri associated with cœliac disease (Haas, 1929), ulcerative colitis (Jones, 1933 ; Mackie, 1935), and chronic bacillary dysentery (Keefer and Yang, 1931). Deficiency may also occur after resections of the gut (Kohn, 1910 ; Urmy *et al.*, 1934) ; I have found low values for the vitamin in two cases of polyneuritis following such operations.

Finally, it is theoretically possible that failure of phosphorylation of the vitamin may cause symptoms and signs of deficiency. It has been proved that vitamin B_1 must be converted into the pyrophosphoric ester before it acts as a catalyst in the body. Little as yet is known about the process of phosphorylation ; according to Ochoa and Peters (1938) it occurs in the liver, and beri-beri has been described in association with liver disease. However, Dr. Goodhart and I have recently found that cells derived from the reticulo-endothelial system (particularly polymorphonuclear leucocytes and nucleated red blood corpuscles) appear to contain a very active

enzyme system for converting vitamin B_1 to the pyrophosphoric ester. It seems that the vitamin rapidly diffuses into the cells and, probably after phosphorylation, is bound to protein. For this reason there is very little vitamin in any form in plasma, and the amount in whole blood varies *ceteris paribus* with the red or white cell count. Further, pigeons have about three times as much vitamin per unit volume of blood as man, the reason probably being that their red blood corpuscles are nucleated and so take up and phosphorylate the vitamin more rapidly. As might be expected, the amount of the vitamin in human blood varies with the red and white cell count. A case of leuco-erythroblastosis and one of myeloid leukæmia gave values too large to estimate by Meiklejohn's method; when blood from the latter case was analysed by the method of Ochoa and Peters (1938), it was found that nearly all the vitamin was in the form of the pyrophosphoric ester. Two cases of lymphatic leukæmia have given normal values for the vitamin in blood. We do not yet know how easily the vitamin is liberated from the complex in the cell, but, as mentioned already, it is possible that the requirement of the vitamin may be increased by an increased number of cells in the blood taking up and "fixing" it. Conversely, these facts help to explain the low values for the vitamin in the blood in some cases of idiopathic hypochromic anæmia. Here three factors may all contribute: the nutritional factor, the low corpuscular volume, and the achlorhydria. The last, however, is inconstant; it, like the low corpuscular volume, is also found in cases of pernicious anæmia, which have given normal values for vitamin in the blood. Verzár has stressed the importance of phosphorylation in the body. For this process to occur he suggests the presence of riboflavin phosphate is necessary, and for riboflavin to be phosphorylated the presence of a hormone of the adrenal cortex is necessary. Although this work is challenged in some quarters, it is possible that the adrenal cortex may be concerned in the phosphorylation of the vitamin B_1 and this, rather than the diarrhœa, may explain the deficiency of the vitamin in some cases of idiopathic steatorrhœa and cœliac disease—conditions which Verzár suggests are due to deficiency of adrenal cortical hormone.

The possible causes of deficiency of vitamin B_1 which have been discussed above explain the low values which I have obtained in the course of analyses of blood in 400 cases. They also explain the incidence of beri-beri amongst the inhabitants of St. Helena, admirably studied by P. B. Wilkinson (1938). They further emphasize the fact that there are many contributory causes for such deficiency, apart from diet.

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Dr. Paul Wood: *The effect of vitamin B_1 deficiency upon the cardiovascular system.*—Vitamin-B_1 deficiency as a cause of cardiovascular disturbance may be rare in this country, but its recognition is important because it is amenable to treatment. It should be looked for in cases of chronic alcoholism, and of prolonged dietetic deficiency, and should be borne in mind in dealing with pregnant women or with cases of right ventricular failure of doubtful ætiology.

Case I.—My interest in this condition was stimulated by an unusual case which I shall now describe. This was the case of a married woman, aged 35, who came into out-patients on June 24, 1937, complaining of diarrhœa immediately after meals, menorrhagia, and of weakness and pains in the limbs.

Previous illnesses include scarlet fever, chicken-pox, measles, whooping-cough, growing pains, and several "septic throats" as a child. She had always been regarded as the delicate one of the family. At the age of 18 she suffered from palpitations, nervousness, trembling fits, pallor, and menorrhagia, but these symptoms improved after marriage at the age of 21. For the next twelve years she was relatively well, and had two healthy babies. Her only complaint was chronic constipation.

In August 1935 she became pregnant for the third time, constipation increased, and she began to suffer from gripping, fluctuating, lower abdominal pains, associated with a desire to open her bowels. During the fourth month of pregnancy lienteric diarrhœa developed, the stools consisting largely of slime. Treatment being unsatisfactory, she resorted to semi-starvation, taking only two slices of white bread and butter and a cup of milk, twice daily; occasionally she ventured a little steamed fish. Fruit, vegetables, and meat disappeared from the diet; no vitamin-B preparation or iron was taken. In the latter half of her pregnancy she complained of pains in the lower limbs and of numbness and tingling in the fingers and toes; when walking she was pulled up by a feeling as if tight bands were being tied round her calves. Six weeks after a normal confinement her child died, but no autopsy record is available.

The patient suffered from continuous menorrhagia for seven months after delivery (until the uterus was curetted) and again for three weeks before coming into hospital. The pains and paræsthesia persisted, and latterly her legs appeared bruised and swollen. Fatigue was a prominent symptom throughout, but palpitations and dyspnœa developed late.

The patient was a thin pale young woman in no immediate distress but very nervous.

The exposed skin surfaces were somewhat pigmented, a pasty greenish brown tint. Fading petechiæ were scattered over the legs. The capillary resistance test was weakly positive. The gums were edentulous, but heart, throat and ears apparently normal, spleen not enlarged, tachycardia, a blood-pressure of 160/100, heart over-

acting showing gallop rhythm ; valves normal, no enlargement ; no congestive heart failure, lungs clear. The abdomen was soft and flat ; no mass nor viscus was palpable, and there was no tenderness.

Physical signs related to the nervous system consisted of slight general muscular weakness, diminished sensation to superficial stimuli in the legs, loss of deep muscle pain on firm pressure of the calves, and of absent knee- and ankle-jerks.

The diagnosis was avitaminosis B and C due to self-imposed semi-starvation because of lienteric diarrhœa and colitis ; the anæmia was probably due to deficiency of iron, of vitamin C, and probable deficiency of the extrinsic hæmopoietic factor, and upon blood loss.

A week later, 30.6.37, she was admitted late in the evening, definitely worse, but the seriousness of her condition was not fully appreciated.

Pallor was more marked and there was slight dyspnœa at rest. The pulse was feeble, heart-rate 120, blood-pressure 120/80, and there was gallop rhythm. Signs of congestive heart failure were not observed. Red cell count 4,320,000, hæmoglobin 68%.

She collapsed in the afternoon of 1.7.37 and at 5 o'clock she was pale, cold, cyanosed, very restless, and short of breath. She was not sweating. The respiration was very deep, rapid, slightly hissing, suggestive of a dry bronchial tree. Though she twisted from side to side to relieve her breathing, she was not interested in a sitting posture. Despite the gross engorgement of the cervical veins the peripheral veins were collapsed. She complained frequently and bitterly of pain and soreness in the stomach.

She was suffering from an extreme degree of pure acute right ventricular failure. When the patient was propped up at an angle of 45°, the cervical veins were markedly distended as far as one could see ; the liver was enlarged and tender ; and there was an extensive pad of œdema at the back of the chest. On the other hand, the lungs were dry, and the air entry was very good down to the extreme base.

The heart-rate was still 120, but the systolic blood-pressure had dropped to 90 mm. of mercury. The size of the heart could not be assessed. There was gallop rhythm, the pulmonary second sound was split and markedly accentuated, and there were no murmurs.

There were no other changes from the previous findings. The temperature did not rise above 97° F. There was no further hæmorrhage, no new petechiæ, and no signs of peripheral venous thrombosis.

An electrocardiogram showed right-axis deviation with inversion of T 3. Only 60 c.c. of urine were obtained by catheter. This contained a moderate amount of pus, but no blood or casts. The amount of albumin present could be accounted for by the pus and the presence of congestive heart failure. The white cell count was 14,000 per c.mm., 78% of which were polynuclears, and the red cells were pale. The blood urea was 220 mgm.%.

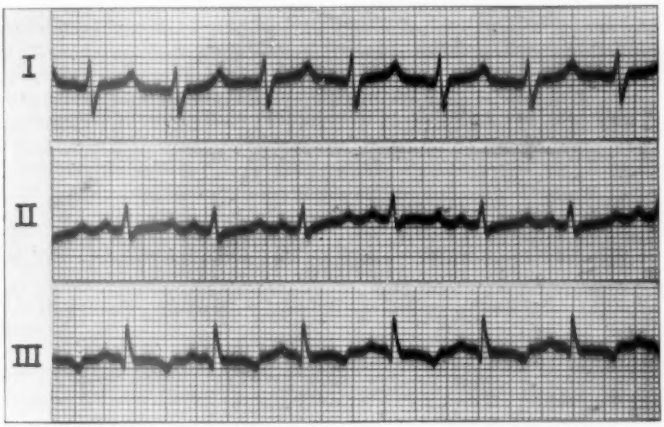
The diagnosis lay between acute cor pulmonale from pulmonary embolism, uræmia and acute fulminating beri-beri. The relatives were then interviewed with regard to the events of the previous week, but no incident suggesting pulmonary embolism had occurred. It transpired, however, that on June 25 the patient had developed a general swelling of the face. Abdominal pain was constant, diarrhœa occurred apart from meals, and she took very little food.

Vitamin deficiency, especially B_1, seemed a more probable causal factor. A reference to Hashimoto's article on an acute pernicious form of beri-beri heart failure showed that the similarity of the two cases was striking and the diagnosis was no longer in doubt. Treatment was commenced immediately, and at 6 p.m. the patient received 2 mgm. (1,000 I.U.) of crystalline vitamin B_1 (aneurin) intravenously, and 4 mgm. (2,000 I.U.) intramuscularly. The preparation used was Benerva (Roche). Since a previous sample of this preparation had contained

histamine the intravenous dose was a cautious one. No reaction followed, and at 10.30 p.m. she was given another 3 mgm. (1,500 I.U.) intravenously, but she did not respond and died at 12.30 a.m. The dose employed may have been too small, but was based on the fact that Hashimoto's case recovered completely after 3 mgm. of purified vitamin B_1 (oryzanin) intravenously.

Post mortem the heart weighed 330 grm.; the right ventricle and auricle were dilated; microscopically there was marked fatty change in the myocardium; the colon was contracted, its maximum diameter was only 2 cm.; there were widely scattered petechiæ; the kidneys were healthy; there was no pulmonary embolus, and the lungs were quite dry and healthy. The pituitary gland did not darken after fifteen minutes' exposure to 0·4% silver nitrate in the dark. (Szent-Gyorygi test for vitamin-C deficiency.)

There can be little doubt this was a case of fulminating beri-beri heart failure. The dietetic history, the associated polyneuritis, and the pure acute right ventricular



Showing right axis deviation with inversion of the T waves in lead III, indicating right ventricular enlargement (Case I).

failure were characteristic. Evidence of peripheral vasodilatation was lacking, but was not especially looked for. This fulminating type of beri-beri is not uncommon in countries where the disease is prevalent. Adequate crystalline vitamin B_1 intravenously usually results in a dramatic cure (Hawes, 1937–38).

From the writings especially of Wenckebach (1928, 1934) and Keefer (1930) I gather that the ordinary cardiovascular beri-beri of the East is insidious in onset and takes a much more chronic course, although there is always the danger of sudden circulatory collapse and cardiac failure, especially when infection is superimposed. Such cases may show peripheral vasodilatation with warm skin, tachycardia, capillary pulsation, bounding arteries, and low diastolic blood-pressure. They also show right ventricular stress or failure with dilatation of the pulmonary artery, accentuated pulmonary second sound and right-sided cardiac enlargement during the stage of stress, and absence of orthopnœa, dry lungs, and the relatively short arm to tongue circulation time associated with a high venous blood-pressure, enlargement and tenderness of the liver, and dropsy during the stage of failure. Electrocardiographic findings are variable. X-ray may show marked prominence of

the pulmonary artery, a sabot type of cardiac apex, and dilatation of the right auricle and superior vena cava.

In the early stages of the condition, when fatigue and palpitations are the outstanding symptoms, one is reminded of the cardiovascular features of extreme anæmia or of thyrotoxicosis with normal rhythm. The severe fulminating type with circulatory collapse and acute right ventricular failure resembles acute cor pulmonale following pulmonary embolism. Diagnosis appears to be simple when marked vasodilatation is associated with obvious right ventricular embarrassment.

Although cardiovascular beri-beri has been known for some years in Louisiana (Scott and Herrmann, 1928), it has only recently been shown in the United States that the polyneuritis, pellagroid lesions, and cardiovascular dysfunctions, associated with chronic alcoholism, disappeared with adequate vitamin-B_1 treatment in spite of the continued ingestion of alcohol by the patients (Strauss, 1935). Weiss and Wilkins (1936, 1937) investigated the cardiovascular disturbances due to vitamin-B_1 deficiency in Boston. The majority of their cases were alcoholic addicts. They found that peripheral vasodilatation, a high venous pressure, and a fast circulation time were characteristic features, but they disputed the view that the left ventricle is spared, and recorded cases with paroxysmal cardiac dyspnœa and pulmonary congestion. 15–40 mgm. of crystalline vitamin B_1 intravenously daily were very effective.

As far as I am aware no similar investigation has been carried out in England. But when such an investigation is carried out the cases of pure vitamin-B_1 deficiency will have to be distinguished from those in which this deficiency is only a factor.

The following case notes illustrate the effect of vitamin-B_1 deficiency on the cardiovascular system of an alcoholic addict :—

Case 2.—W. H. H., male, aged 76, admitted 4.8.37 complaining of shortness of breath.

History.—Apart from a slight winter cough for many years he had been quite well until three months before admission, when he became short of breath. Despite having a holiday his condition deteriorated up to the time of admission, when he was breathless at rest. There had been no paroxysms of nocturnal dyspnœa, no nocturia or dysuria, no wheezing, and no cardiac pain. Previous illness, a single attack of pleurisy twenty years previously. Family history not significant.

He was a waiter and regularly consumed moderate amounts of all kinds of alcohol. His diet included plenty of fruit and vegetables. No details of meals available.

Findings on admission : Short of breath when at rest, but not orthopnœic, slightly cyanosed, the cervical veins were not engorged, liver enlarged and tender, moderate ascites and œdema. Lungs not markedly congested, but few basal râles, the arm-to-tongue circulation time measuring only 22 seconds.

Auricular fibrillation was present. Radiologically the heart was moderately enlarged, all chambers being involved, and the aorta was dense and unfolded. There was no evidence of organic valvular disease, but there was a harsh mitral systolic murmur. The peripheral arteries were somewhat thickened, the fundi were normal, and the blood-pressure was 165/90–130/85.

Knee-jerks were sluggish, ankle-jerks, and abdominal reflexes absent. Pupils were normal as were the other reflexes and deep tendon-jerks. Pain, touch, and vibration sensations normal, no pain in the limbs and no paræsthesia.

Plasma proteins 7·45 grm.% ; albumin 3·7 grm.% and globulin 3·38 grm.% ; red cells 5,300,000 per c.mm. ; hæmoglobin 106% ; white cells 12,000 per c.mm., of which 78% were polymorphs. The Wassermann and Kahn tests were negative. The urine contained a trace of albumin, its specific gravity was between 1020 and 1030 at first and 1002 and 1020 when he had recovered. The urea clearance test was 52% of normal.

Diagnosis.—This was clearly a case of congestive heart failure with auricular fibrillation. The findings suggested failure of the right ventricle more than failure

of the left, but the electrocardiogram and the skiagram were against chronic cor pulmonale. The moderately thickened arteries and the unfolded aorta suggested hypertensive heart disease, but the blood-pressure was not elevated significantly, and the electrocardiogram did not suggest left ventricular enlargement. The X-ray, although compatible with such a diagnosis, was not strongly in favour of it.

In view of the history of moderate alcoholism and the absent ankle-jerks, vitamin B_1 deficiency was considered as a possibility.

Treatment: Absolute rest in bed and fluid intake restricted to 1,200 c.c. daily. On the evening of the third day he was obviously going downhill. The ventricular rate was steadily rising. He was given 4 mgm. of aneurin intravenously. On the fourth day the ventricular rate had risen to 145 and he received another 4 mgm. of aneurin intravenously, after which he appeared to improve and the ventricular rate fell quickly. On the fifth, seventh, and ninth days, he received 2 mgm. of aneurin intramuscularly. He was now so improved that further treatment was considered unnecessary. The venous blood-pressure returned to normal, the liver decreased in size, the ascites and œdema cleared up. After three weeks he was allowed up and seemed remarkably well. There was no dramatic diuresis, but after the first week the urinary output approximately doubled. He was given tabs. dig. pulv. gr. i t.d.s. as a safeguard against undue tachycardia with effort, although his ventricular rate was 80–90 per minute.

He returned to work for three months but the dyspnœa returned; he did not improve with treatment in another hospital up to the time of the international crisis of 1938, when he was discharged. Throughout this period and until his readmission on October 28, 1938, he had no special vitamin-B_1 treatment. On admission there was generalized anasarca. His venous blood-pressure measured 25 cm. of water and his arm-tongue circulation time 27 secs. He received 50 mgm. of aneurin intravenously, but did not respond and died two days later.

Post-mortem showed little; the heart weighed only 435 grm. but little more than half the average weight of hearts which have failed for about twelve months from hypertension. No obvious valvular or myocardial disease.

I understand from Dr. Sinclair, who kindly estimated the amount of vitamin B_1 in the blood before the patient received his last injection, that gross deficiency was found. I do not claim that this was a typical beri-beri heart failure, but rather that vitamin-B_1 deficiency was a major factor in accelerating the death of a man of 76 with auricular fibrillation.

The diagnosis of cardiovascular disturbance due to vitamin-B_1 deficiency rests on the dietetic history, characteristic clinical features, the associated polyneuritis, the demonstration of reduced amounts of vitamin B_1 in the blood or urine, and the dramatic effect of adequate treatment with the vitamin. It may be supported by the demonstration of pyruvic acid in the blood, and by positive adrenaline (Aalsmeer)[1] and pitressin (Wenckebach)[2] tests.

Autopsy studies of the heart in fatal cases of beri-beri have yielded nothing specific. Wenckebach's theory (1928) of water retention has not been proved. Weiss and Wilkins (1937) state that the water content of the ventricles in some of their cases was similar to those of normal controls.

Treatment consists of the intravenous injection of from 10 to 50 mgm. of crystalline vitamin B_1 daily in severe cases, and of intravenous, subcutaneous, or oral administration of smaller amounts (5–10 mgm.) in the milder forms.

[1] After 1 mgm. of adrenaline subcutaneously the signs of peripheral vasodilatation are markedly accentuated and the cardiac action becomes stormy. The intensity of the reaction varies directly with the severity of the beri-beri.

[2] The pitressin test. Wenckebach found that after an injection of pitressin the signs of peripheral vasodilatation disappeared and the cardiac action became peaceful for a period of about twenty-five minutes.

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Dr. C. C. Ungley[1] reported a case of beri-beri complicating pyloric stenosis in an unemployed labourer, aged 29, who had suffered from duodenal ulcer for eleven years and recently from vomiting due to pyloric obstruction. He showed an œdema most marked in the lower limbs ; the heart was not enlarged. He gave a positive Aalsmeer test. His diet was probably just sufficient for a normal man of his weight. The B_1 deficiency was probably due to impaired assimilation or to destruction of the vitamin. The response to vitamin B_1 was dramatic. Weight fell, appetite increased, circulatory conditions rapidly improved, knee and ankle jerks returned, and calf tenderness disappeared. The vitamin-B_1 content of the blood was low before treatment. Some 30 cases of polyneuritis investigated by the author support the view that the polyneuritis of alcoholism, pregnancy, and gastro-intestinal lesions, in some cases at least, is due to nutritional deficiency.

Dr. R. S. Goodhart : The variety of pictures presented in beri-beri heart disease frequently makes correct diagnosis impossible, except through elimination or response to adequate vitamin-B_1 therapy. In this connexion it is important to bear in mind that right-sided cardiac dilatation is not essential for the diagnosis.

The amounts of vitamin B_1 given in the treatment of beri-beri are often much too small. The therapeutic dose should never be less than four times the maintenance dose as calculated according to Cowgill's formula. As the maintenance dose for the average adult male is approximately 1 mgm. of the crystalline substance, the therapeutic dose should be at least 5 mgm. of crystalline vitamin B_1 daily. Under some circumstances doses as high as 50 mgm. daily may be quite reasonable.

Pellagra is frequently found in alcohol addicts and is no longer considered to be a different disease in them from the endemic form. The skin, mucous membrane, and central nervous system lesions of pellagra have been shown to respond by improvement to nicotinic acid therapy. The peripheral neuritis which frequently occurs in association with this disease does not respond to this treatment, but does respond to vitamin B_1 therapy. It might therefore be more reasonable not to regard peripheral neuritis as an intrinsic part of the disease pellagra. The essential pathology of pellagra is the mucous membrane lesion, such as stomatitis. The extent and severity of the skin lesions depend largely on environmental factors. The mental symptoms are of several types : gradual deterioration, Korsakoff's psychosis, and encephalopathy. The action of nicotinic acid upon the encephalopathy has yet to be proved to be a direct one : the improvement in the encephalopathy might be secondary to the improvement in the mucous membranes with the consequent improvement in the general well-being and nutrition of the patient.

The therapeutic dose of nicotinic acid is 100 mgm. or more daily. Spies recommends 100 mgm. five times daily for the treatment of pellagra.

It is most important for the practitioner to realize that no one deficiency is likely to occur alone in human beings. In treating the patient, a well-balanced diet, rich in all the essential food factors, should be supplied with the addition of therapeutically active amounts of the particular factor or factors from the deficiency of which he is chiefly suffering.

[1] Ungley, C. C. (1939), *Newcastle Med. J.*, **19**, 43 ; (1938), *Lancet* (i), 981.

Section of Orthopædics

President—R. OLLERENSHAW, F.R.C.S.

[*January* 17, 1939]

Osteoclastoma of Ischium and Pubis Treated by Teleradium.—K. I. NISSEN, F.R.C.S.

Miss E. M., aged 37. Housekeeper.

First seen in May 1938. Complained of dull pain over the right tuber ischii for eleven months, followed by swelling in the buttock.

E M. 9.6.38.

E M. 30.11.38.

E. M. 4.1.39.

On examination.—A large rounded tumour, slightly tender, presented in the right gluteal fold and the adductor region. Hip movements were limited by about 50% in all directions. X-rays showed a lesion of the whole of the ischium including the spine, and of part of the pubis, with faintly calcified outlines and trabeculæ. Biopsy : Osteoclastoma.

Treatment.—The patient was treated at the Westminster Hospital Radium Annexe by the 4-grm. radium bomb. In June and July the main tumour mass received 3,000 r units. During treatment marked spasm of the hip developed.

Progress.—By the end of November the patient had returned to full work and the tumour was barely visible. Hip movements were almost full. The increase in circumference of the upper thigh had diminished from 3½ to 1 in. X-rays showed early recalcification but slight further invasion of the pubis. The plasma phosphatase had risen from 9 units (normal 3 to 13) to 18 and 21 units.

The following cases were reported :—

Osteoclastoma of trochanteric region.

Woman aged 46. Referred after incomplete excision, and treated by a radium plaque. Six months later residual tumour densely calcified and easily excised.

Osteoclastoma of ilium.

Man aged 64. Two-thirds of ilium involved, with expansion, trabeculation and pathological fracture. Treated by deep X-rays only. Eight months later outlines of ilium almost normal.

Osteoclastoma of sacrum.

Woman aged 21. Almost the entire sacrum involved, with extension through one sacro-iliac joint. Treated by 4-grm. bomb. Marked recovery of sacral nerve paralysis, but development of severe urinary sepsis.

Osteolytic lesion of head of femur.

Man aged 21. Treated as tuberculous hip from 1926 to 1929. No biopsy. When seen in 1930 neck of femur and acetabulum extensively involved with early calcification in surrounding tumour. Treated by 4-grm. bomb. A year later, dense calcification and bony ankylosis. No change since. In view of history and response to treatment osteoclastoma considered the most likely diagnosis.

Comment.—Mr. Nissen remarked that to produce a healing reaction an osteoclastoma requires only moderate irradiation, about 3,000 r units. This low dosage makes the risk of skin damage almost negligible. External radiation by a radium bomb or deep X-rays has displaced the dangerous implantation of needles or seeds.

Compared with osteogenic sarcoma, the response is slow, calcification seldom being marked before six months after treatment. Cases showing gross expansion with destruction of cortical bone are difficult to deal with surgically and frequently recur. In treatment by radiation, however, a thin shell favours healing by allowing collapse.

The cases had been reported with the assistance of the Staff of the Westminster Hospital Radium Annexe.

Scalenus Anticus Syndrome.—B. H. Burns, F.R.C.S.

Miss J. H., writer, aged 26.

This case is presented as an example of relief of pain in the upper limb by division of the scalenus anticus muscle. It is thought that the operation is of benefit to a wider range of cases than those showing the complete classical picture due to pressure of cervical rib or a high 12th rib. In this case, the severest pain was referred to the middle of the collar-bone.

History.—In March 1937 she complained of pain on the right side of the neck in the region of the collar-bone. The pain only came on when writing, which she had the habit of doing on a suitcase on her knees, with her shoulders in a forward attitude. She felt that something in her neck was pulling tight and hoped to relieve this by shrugging her shoulders, but it made no difference. In February 1938 she complained of swelling of the back of her hand, which became purple as when very cold. She also complained of an ache all down her arm, and pins and needles in the tips of all fingers of the right hand. The chief pain was felt in the region of the clavicle and, to a lesser extent, the base of the neck posteriorly. At the same time, she also noticed a weakness of the hand and she found she could not play the piano so well as formerly.

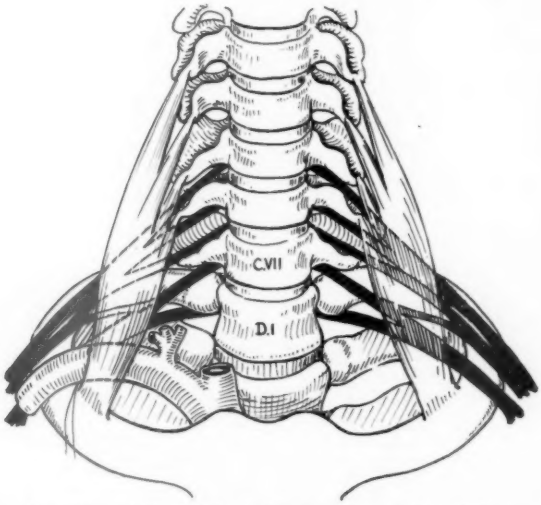

Diagram shows the relation of the scalenus anticus to the subclavian artery and brachial plexus.

Turning the head, as in backing a car, gave rise to bad pain. These symptoms continued and were present when first seen in June 1938.

On examination (beginning of June 1938).—Swelling of hand less than it had been. Dilated veins over upper arm. Slight tenderness over centre of clavicle. Grip of right hand definitely weaker than left. Extreme rotation of head towards affected side increased pain. Shoulders markedly sloping. Further physical examination, X-rays, &c., gave no additional information.

After many examinations and discussions, it was decided to explore the root of the neck. Nothing abnormal was found, but the scalenus anticus muscle was divided at its insertion. She has had no pain or swelling since.

Comment.—Since Adson, in 1927, showed that the symptoms associated with cervical rib could be relieved merely by division of the scalenus anticus tendon, without removal of the rib, the importance of the scalenus anticus as a factor in causing pressure on the brachial plexus and subclavian artery has been increasingly realized.

It is now well recognized that cases showing those symptoms classically

associated with cervical rib, but where no cervical rib exists, can be also relieved by division of the scalenus anticus muscle.

Recently, there have been two articles in American surgical journals which seek to show that a wider range of symptoms may be due to pressure of the scalenus anticus muscle.

In a typical case of cervical rib, say in a young woman aged 20, the symptoms and signs are mostly referable to pressure on the lower cord of the brachial plexus and subclavian artery. Typically, the patient is a young woman and complains of pain in the ulnar border of the forearm and hand with tingling and numbness here, there is weakness of the inter-ossei and wasting of the ulnar border of the forearm, the hand is blue and apt to be cold. There are cases where the chief pain was elsewhere in the area supplied by the brachial plexus, but that it could be relieved by section of the scalenus anticus is shown by the effect of that procedure. For instance, in the case here described, the severest pain was referred to the middle of the clavicle.

Although, in this case, probably the chief ætiological factor was the excessive descent of the shoulder girdle, many cases show no such anatomical variation. The effect of this is, clearly, to increase the angulation of the structures passing over the first rib. The usual onset of symptoms at the end of adolescence may be accounted for by the fact that the shoulder girdle reaches its maximum descent at this time.

The scalenus anticus muscle is supplied by the 7th cervical nerve and it is said that any painful condition in the area supplied by the 3rd to the 8th cervical root may set up a reflex stimulation of the nerve, resulting in spasm of the muscle. This, in turn, will further irritate the roots of the brachial plexus and thus further stimulate the 7th cervical nerve, thus setting up a vicious circle, as described by Oschner. Also the contraction of the muscle may somewhat raise the first rib, thereby increasing the angulation of the structures passing over it.

Freiberg says that, in certain circumstances, any lesion involving the cervical spine or shoulder girdle may be the exciting factor in causing the syndrome. In differential diagnosis, Oschner considers cervical rib, subacromial bursitis, supraspinatus tendon tear, Raynaud's disease and brachial neuritis.

This case is discussed because the condition, scalenus anticus syndrome, does not yet seem to be so widely recognized here as in America. Recognition of the fact that many cases of pain in the upper limb are included in this syndrome is important, as a complete and lasting cure can be obtained by division of the scalenus anticus muscle.

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Mr. NORMAN CAPENER commented on the frequency of the symptoms of pain and paræsthesia in the shoulder and arm secondary to osteo-arthritis of the cervical spine, these symptoms, he thought, were due to some fixation of the brachial plexus and increased by scalenus anticus spasm, particularly in middle-aged women with a low shoulder girdle. Where conservative treatment failed scalenus tenotomy seemed to be indicated.

The scalenus anticus muscle was, he thought, a structure of great importance in the cause of circulatory and sensory disorders in the hand after injury of the upper extremity for which immobilization had been carried out in the dependent position for too long. In this connexion he referred to the work of Geoffrey Lillie.[1]

[1] G. J. Lillie, A nocifensor lesion of the hand, *Brit. M. J.*, May 22, 1937 (i), 1068.

Three Cases of Spontaneous Rupture of the Extensor Pollicis Longus Tendon.—G. C. SAWYER, F.R.C.S.

I.—E. N., aged 28.

Whilst dancing on 10.11.37 sustained Colles' fracture left wrist, reduction performed. Immobilized in plaster five weeks. United well. Excellent result. Discharged 9.2.38. During April 1938 injured left thumb and attended hospital complaining of inability to extend terminal phalanx. Immobilized in plaster for four weeks.

Operation (21.6.38).—Exploration of extensor pollicis tendon which was found to have degenerated and ruptured at site of old fracture. Transplantation of distal end into abductor pollicis tendon.

II.—E. J., aged 18.

Sustained Colles' fracture left wrist on 6.10.38 with no displacement. Immobilized with plaster slab for four weeks. United well. Recovered with excellent function. Discharged on 16.11.38. Suddenly on 2.12.38 noticed inability to extend terminal phalanx of thumb. Now awaiting tendon transplantation.

III.—L. T., aged 17.

Injured right wrist on 25.10.38, complained of pain, but did not attend hospital. First attended on 28.11.38 complaining of inability to extend terminal phalanx of thumb. X-ray suggested slight juxta-epiphyseal injury on dorsal aspect of radius.

Comment.—In all cases a variety of Colles' fracture had preceded the rupture. Displacement was not a feature of the fracture and in the last two cases was non-existent. Rupture of the tendon occurred at five months, two months and five weeks after the injury.

The tendon ruptures secondary to degeneration occurring in the bony canal which is roughened and irregular after the fracture. At first the tendon is frayed and thinned with the friction, lengthening occurs and later actual rupture.

It has been suggested that pressure of the plaster slab is a factor but this is unlikely. In the last case, the patient did not attend hospital for any treatment until rupture had occurred.

Operative treatment in the form of end-to-end suture is rarely possible and some form of tendon transplant is necessary. Free transplants can be used but a useful functional result is obtained by transplantation of distal end into the abductor pollicis longus tendon. This operation was performed in the first case.

Mr. H. E. HARDING described the operation of transplantation into the abductor pollicis and considered adduction of the metacarpal was essential in addition to extension of the terminal phalanx.

Notes on a Case of Bilateral Arthritis of the Hip-joints treated by Capsulectomy.—LANCELOT H. F. WALTON, L.R.C.P., M.R.C.S.

B. H., aged 43, Southern Railway guard.

First seen August 1936 complaining of pain in left knee, both hips and low back.

History.—Started pain in groins 1918, at age of 25 following dysentery. Sores over knees and hips whilst in Mesopotamia. In 1929, manipulation of both hip-joints at St. Bartholomew's Hospital which temporarily improved movements, but did not materially relieve pain.

On examination.—Marked stiffness of both hip-joints—movements reduced, rotation completely absent, flexion 40°, abduction and adduction 20°. Wassermann reaction negative. Blood-sedimentation rate 1 hr., 6 mm., 2 hr., 15 mm. (Westergren) (*see* fig. 1).

Physical treatment combining heat, massage, &c., did not give any relief.

Patient shown at the Royal Society of Medicine in October 1936 for advice. Mr. Fairbank suggested capsulectomy and synovectomy of hip-joints.

FIG. 1.—B. H., aged 43. When first seen, August 1936.

FIG. 2.—After operation on both hips. Although now free from pain, and movement increased, there is not much change in general appearance other than slight increase in joint line.

November 17, 1936: Operation of left hip-joint. Synovectomy—Smith-Petersen approach—removal of as much of the capsule, synovial membrane, and osteophytes as could be reached. Followed complete rest in bed—nine weeks (delayed healing of point of wound).

Discharged from hospital January 20, 1937, attended as out-patient for physical treatment.

February 1937: Left hip movements fair and free of pain. Unoperated right hip pain rather worse for the rest, but chief symptom—backache. After three months'

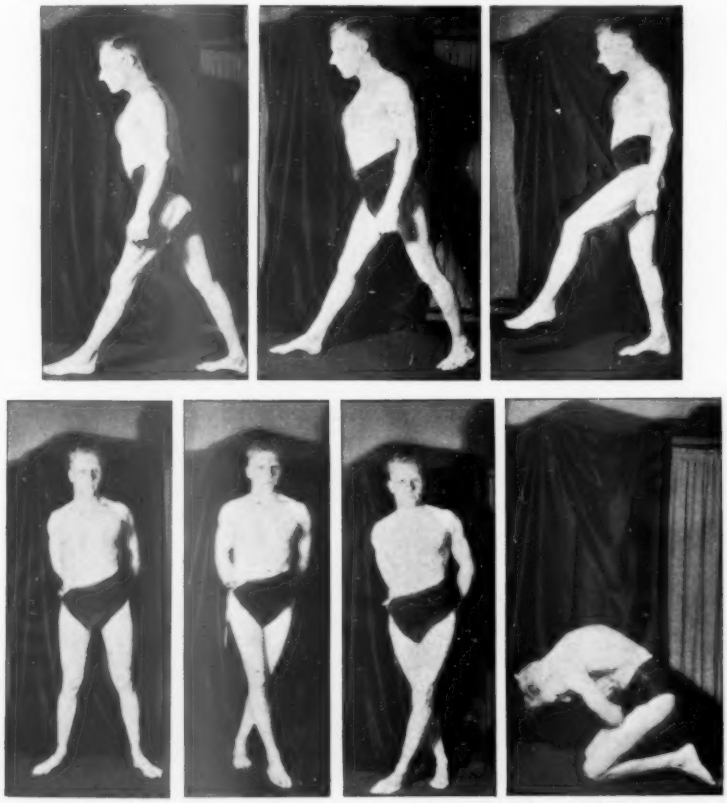

FIG. 3—To show present range of movement at hip-joints. March 1939.

treatment by lumbar diathermy, radiant heat, massage and exercises both hips; sent Droitwich for three weeks for treatment in baths.

Returned with greater strength—free from pain in left hip, but still pain in right hip and back.

July 1937: Readmitted to hospital at patient's request for similar operation on right hip.

July 17, 1937: Operation similar in approach and detail. Discharged after five

weeks—August 20—allowing weight with crutches. Still complaining of back—found to have many tender fibrositic areas along iliac crests.

Strong counter-irritation applied to each area (mercury vapour (penny size areas) 15 min. at 12 in.).

November 1937 : Sent to Droitwich again for three weeks.

December 23, 1937 : Returned better—range increased in both hip-joints, back pain gone—can lift left leg from hip but not the right yet.

Right hip still tender around scar—counter-irritation applied to this area and faradism for all hip muscles and quadriceps.

February 24, 1938 : All treatment ceased. Returned to work but now as ticket collector.

From this date, patient has remained entirely free of pain in hips and back. A further period of treatment of several weeks was given commencing July 1938, in an effort to increase movement. Ultratherm cable applied to one hip, and histamine ionization to the other. Some increase of movement was thus obtained in each joint allowing an increase in stride and a greater feeling of freedom (*see* figs. 2 and 3).

The following were also shown :

By Mr. G. O. TIPPETT : I.—**Case of Bilateral Injury to Biceps Muscles.**

II.—**Skiagrams of Case of Fractured Neck of Femur.**

III.—**Skiagrams of Case of Herniation of Nuclear Prolapse of Intervertebral Disc following Manipulation of Spine.**

By Mr. C. LAMBRINUDI : **Sinus in Bone Treated by Thiersch Grafts.**

Section of Otology

President—E. D. D. Davis, F.R.C.S.

ADDENDUM

Proceedings, 1939, **32**, 511 (Section of Otology, p. 39)

After Mr. W. A. Mill's remarks *insert*

Mr. F. W. Watkyn-Thomas, replying, said that he was sceptical about the value of the bone-conduction test; the methods were uncertain and the factors concerned little known. The hearing tests alone were not much value.

The heresy that the Wever-Bray response was a measure of hearing was entirely against clinical evidence.

As to Mr. Hallpike, he had in his paper safeguarded himself on that point rather carefully, because one must admit that there was bound to be a rise in pressure so long as the duct was open.

For protection against continued noise he had found soft plugs, which could be moulded to fit the case, most useful.

syndrome with the recurring attacks of vertigo, perhaps associated with vomiting and falling, deafness, gradually increasing, and tinnitus. Even in the recently published textbooks there is a marked hesitancy to advise operation for the condition.

Dandy says " although spontaneous cures do occur in Ménière's disease they are probably rare. The occasional long intervals between attacks often mislead victims into a feeling of a false security and into the hope or assumption of cure.

" So devastating are the attacks that patients live in constant terror of their recurrence. They are, of course, prevented from working where a sudden fall might cause disaster; many pleasures of life are denied them, and all too frequently they shun society, remaining at home where they may be, in a degree at least, better able to withstand the attacks, which demand immediate attention."

Dandy mentions that Dean Swift and Hughlings Jackson suffered from Ménière's attacks during much of their lives. A distinguished American man of letters, Gamaliel Bradford, was also a victim. During the last twenty-five years of his life there was little relief from the recurring attacks which he described so aptly as the " swoop of hawks ".

In 1870 Charcot showed cases of Ménière's disease at his clinic and recorded that in some patients when the deafness became complete the attacks of vertigo ceased. This led him to suggest that division of the 8th nerve should bring about a cure of the condition.

The first operation on the labyrinth for the relief of the condition appears to have been done in 1904 by Richard Lake. He performed a radical mastoid operation, then removed the semicircular canals and opened the vestibule. The patient was a young woman who had suffered from attacks of vertigo, associated with sickness, deafness, and tinnitus for five years. She could walk within ten days of the operation and the attacks did not return.

In 1912 Lake read a paper in which he stated that he had operated on 20 out of 70 cases of vertigo seen in six years. Of these 14 were cases of Ménière's syndrome. In the other six cases there had been previous suppuration.

At that time he wrote: "When, however, one meets with patients in whom the vertigo is severe and often repeated, where the deafness is of a high grade, where the stapes is obviously fixed by osseous formation, where internal and external medication are unavailing, and where the patients' state is such that a continuation of life under such conditions is impossible by reason of their inability to earn their own livelihood, or some equally potent cause, then one should without hesitation place before them the advisability of operation. In no case should operation be considered where the hearing is good, nor, I think, where it is useful. When it is so reduced as to be a negligible quantity the matter is different and stands on the same footing as if the patient were completely deaf." I think these indications for operation would still be considered reasonable by most otologists.

Macleod Yearsley, who assisted Lake at his first operation, first performed a very similar operation in 1908 and has done it altogether five times with good results.

In 1897 Cheatle read a paper on "The conducting portion of the labyrinth". In that paper he said he could not help being struck by the comparative clinical resemblance between glaucoma and so-called Ménière's disease. Speculation on this theory led one to imagine that operative interference for the relief of increased labyrinthine tension by puncturing the outer labyrinthine wall might, in the future, be within the realm of practical surgery. To Cheatle, therefore, must go the credit of first suggesting a relatively minor procedure for the relief of these patients.

It occurred to Jenkins also that there might be increased pressure in the labyrinth in Ménière's syndrome and the similarity to glaucoma also occurred to him. In 1911 he read a paper to the Section of Otology in which he mentioned this and he showed a case of a young man aged 23 who had suffered from giddiness (Ménière's syndrome non-infective). At operation he opened the left external semicircular canal. The result was complete cure of the attacks of giddiness, and it is interesting to notice that there was considerable improvement in the hearing with a diminution of the tinnitus. This appears to be the first relatively minor operation performed for the relief of Ménière's syndrome.

Peters in 1913 showed a case to the Section of Otology in which he had made an opening into the external semicircular canal and placed one end of a fine silkworm suture in the canal and the other end between the dura and the cranium. There was no further giddiness. The hearing at first was improved but later degenerated. This case was shown again in 1929 to the Otological Section.

Mollison in 1923 opened the external semicircular canal. The patient was cured of his vertigo. It is interesting to note that in this case the hearing at first improved but later the man became quite deaf. He mentions three other cases operated on in one of which alcohol was injected into the labyrinth. He states that Cheatle first suggested opening the canal for the condition and mentions that it had been carried out by Jenkins, Hugh E. Jones, Sydney Scott, and others.

Sydney Scott had shown that the injection of alcohol into the labyrinth of pigeons destroyed labyrinthine function.

Mollison described his operation of opening the external canal and injecting alcohol at the summer meeting of the Otological Section of the Royal Society of Medicine at Bristol in 1935. Of 30 cases operated on 28 were traced. 22 were cured, three improved and three quite unaffected although the function of the labyrinth had been successfully destroyed.

Hautant in 13 cases of vertigo due to "lésions scléreuses labyrinthiques" opened the canal but did not inject. Seven cases were cured, four improved and two did not change. In 30 cases where vertigo followed old healed suppuration all were cured by opening the canal.

McGibbon, quoted by Mollison, opened the canal in eight cases with seven cures.

In the St. Thomas's Hospital Reports 1936 I reported eight cases. One unfortunately died of heart failure some days after operation. The others were all cured of the attacks of vertigo.

Altogether I have performed the operation 17 times. One patient died and one is too recent ; one is untraced.

13 of the remaining 14 have been traced. One who had been told he would never walk again returned to his work and for some time was very well. He has since developed a hysterical gait. Unfortunately he writes that he is not to continue with the psychologist to whom I sent him as his doctor has told him " they can do him no good ".

None of the remaining 13 has had any further giddy attack and none has fallen since the operation. Ten complain of occasional unsteadiness, usually when walking slowly at night. Three have no giddiness whatever. All are stone deaf in the ear operated on. Four get no noises in the operated ear (two of these had no noises previously). Four state the tinnitus is much less and only occasional. In three the tinnitus is about the same and in two it is worse. All are able to work ; two as police constables. Several mention that they can now climb ladders which before they were unable to do.

Since then, A. J. Wright has described his method of destruction of labyrinthine function by the injection of 1 minim of alcohol by passing a needle through the tympanic membrane and footplate of the stapes. He reported that he had treated successfully 15 cases. The procedure is much more trivial than the operation of Mollison and should be especially suitable for people who cannot stand a longer anæsthetic.

Peacock has described a modification of this method of injection which he calls balanced suction. He found by using an X-ray opaque fluid that the smallest amount of fluid which passed through all the canals was $\frac{1}{2}$ c.c.; 3 c.c. were required completely to fill the cochlea and canals. Using a needle with a double lumen and injecting and sucking out he argues that otitis media and facial paralysis are less likely if no excess of alcohol is left. He has reported two cases successfully treated.

In America after opening a semicircular canal diathermy has been used to destroy the labyrinthine function. T. J. Putnam describes two cases in which the superior canal was opened after removal of bone as for a subtemporal decompression. Putnam claims that a cleaner and more anatomic dissection is possible with this approach. With the careful application of the coagulating current hearing may be preserved.

Dandy in America and Cairns in England have operated on the 8th nerve. The first operation for division of the 8th nerve is described in the *Transaction* of the Clinical Society by Cuthbert Wallace and Marriage. It was undertaken largely for the relief of tinnitus. The patient also suffered from vertigo. Unfortunately death occurred three weeks after the operation. The tinnitus, although it was relieved, still continued. Dandy has operated on more than 200 patients without a fatality and with uniformly good results.

Crowe reports 117 cases of Ménière's syndrome. In 23 the disease was relatively mild and no immediate operation was necessary. In the remaining 94 the attacks were severe so that many had been treated in various ways including the elimination of septic foci. Crowe says : " Brain surgery has developed to the point where opening the skull to divide a nerve entails no more risk than opening the abdominal cavity." In 49 patients the 8th nerve was divided completely with cure of the vertigo. In 45 cases the vestibular nerve alone was divided, again with cure of the vertigo. A surprising result was that in 22% of these cases an improvement in hearing followed. In the one illustrative case tinnitus was abolished by the operation and this abolition of the tinnitus perhaps accounts for the result.

Dandy in recording 42 cases (in 39 of which the whole nerve was divided), finds

that the chances of total disappearance of the tinnitus are slightly more than 50% and those of improvement 20%. The vertigo always disappeared.

Putnam in his paper, already mentioned, says that the accepted method of treatment for the condition in America is division of whole or part of the 8th nerve. He mentions that excellent results have been obtained by Coleman, Munro and McKenzie. He says that unreported deaths have occurred and mentions that in only three cases in the literature was the operation considered a failure. Success is not always so absolute. The procedure, he says, is not always as easy, rapid and safe as some accounts would lead one to believe.

Portmann, believing that the condition was due to alterations in pressure in the labyrinth, devised an operation for drainage of the saccus endolymphaticus lying in the fossa endolymphatica on the posteromedial surface of the petrous bone. He reported two cases operated on and cured and mentions that he has several times performed the operation.

Musgrave Woodman who has performed the operation a number of times now contents himself with deliberately rupturing the ductus endolymphaticus and does not incise the saccus. In five patients complete cure resulted and in one other there is improvement.

It is interesting to note from Hinton, writing in the Supplement to Toynbee's book, that alteration of and probably increased labyrinthine pressure was thought to be responsible for the symptoms. The recent paper by Hallpike and Cairns is the first and historic demonstration of the actual changes in the labyrinth.

Wright's hypothesis of focal labyrinthitis is an interesting addition to the literature of the disease, and he made a very valuable contribution in emphasizing the necessity of clearing up septic foci.

It will be seen, therefore, that Ménière's syndrome at the present time is being treated in a number of different ways. Up till now, however, the results of some of these ways have not been given really fully. Members of the Section have, no doubt, had experience of one or more of these methods and it will be most interesting to hear of their results.

I have only injected alcohol with complete destruction of labyrinthine function when I have felt that complete deafness in one ear would not make the patient too deaf for ordinary life. All the cases that I have seen except one have fallen into this group. The one case I referred for division of the vestibular part of the 8th nerve.

Dandy's results are certainly most striking and perhaps we should more frequently advise the procedure he advocates. There is no doubt that nowadays relief of this distressing complaint can and should be given where necessary by surgery.

I shall be most interested to hear the experiences of those who have not completely obliterated labyrinthine function by alcohol injection or in some other way. It will be interesting to know the results as they affect the hearing and the tinnitus as well, of course, as the effects on the attacks of vertigo.

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Mr. W. M. Mollison: Mr. Mill suggested four reasons for operating on the labyrinth: (1) labyrinthitis; (2) meningitis; (3) Ménière's syndrome; (4) otosclerosis. He has dealt with (3) leaving me to discuss the rest.

It is some time since the Section has discussed the question of operations on the labyrinth for acute or indeed chronic inflammations and I am going to suggest that operations for these conditions including translabyrinthine drainage are obsolete; that the various partial or complete labyrinthectomies are things of the past. Since I have never performed one of these operations (and I hope my mortality figures are not much higher than the average) I shall be interested to hear the opinions of members. I know labyrinthectomy is still performed as I am aware of two such operations during the last nine months, though not the reasons for operation.

I can appreciate that operation might be called for in the rare cases of acute streptococcal invasion of the labyrinth: but feel that in the future prontosil and continuous lumbar puncture may replace operation. Reference to the most recent edition of Ballenger's textbook tends to support this view; in the chapter on the "Surgery of the Labyrinth" Loewy, the author, writes "there is much diversity of opinion on when to operate, how to operate and when to pursue an expectant course . . . but on one condition most otologists are agreed namely that the advent of intracranial complications demands immediate mastoid and labyrinth exenteration combined." I much doubt whether this has ever been true of otologists in this country.

The author then adds a footnote which seems of great importance and which contradicts the previously expressed views: "that he knows of four cases of hyperacute otitis due to hæmolytic streptococcus in which meningitis occurred early before a definite mastoid involvement. These four cases recovered under sulphanilamide therapy and blood transfusions—without operation. Since operation alone has met with poor success in these acute cases we must reconsider the former opinion that intracranial complication is an indication for immediate surgery."

Some three or four years ago Mr. Cann had a success in one of these cases—he opened the external canal finding a blood-stained fluid from which hæmolytic streptococci was cultivated; he instituted continuous lumbar puncture for some days to deal with the meningitis, and the patient recovered.

There are cases in which suppuration round the internal ear results in sequestration of the whole labyrinth and then operation is performed to remove the whole labyrinth.

Lastly, operation to open the labyrinth is advised in certain cases of complication after fracture of the temporal bone by Ramadier and Caussè in their *Traumatismes de l'Oreille*.

To pass to the fourth reason for operating on the labyrinth: the attempt to restore hearing in cases of otosclerosis and, perhaps we may add, chronic progressive dry middle ear catarrh, since without microscopical examination the two diseases are indistinguishable.

The early attempts were directed against the stapes but though some improvement was gained the operation was too dangerous and was abandoned. In recent

years operators have turned their attention to the canals. Jenkins, Holmgren, Sourdille, Lempert, Howarth and Bateman have opened the external, posterior or superior canals and have endeavoured to keep the fistula open by covering it with various substances. All are agreed that as soon as the fistula is made the hearing is improved in a remarkable degree, but that to keep the fistula open is extremely difficult. In the few cases in which I have had to reopen the wound after a previous operation to open the external canal the complete bony restoration of the canal has been striking.

Mr. Jenkins has kindly sent me some notes of his early cases. It was his opinion that otosclerosis might be to some extent due to changes in the labyrinthine fluid. He opened the external semicircular canal with the object of altering the physics of the fluid and not with the intention of making another window.

The results were good in all cases for a time but the final results at the end of four to six months were not such as to justify operation.

Sourdille has published cases in which he was satisfied that improvement was permanent; I have only seen one of his cases and though the patient said she heard better I could not detect improvement by my tests. In 1936 Holmgren published a description of his technique and results; he opens the external and posterior and sometimes the superior canals under local anæsthetic using magnifying spectacles; he covers the fistula with gold-leaf, rubber or fat. He quotes several cases in which definite improvement in hearing lasted one and a half years. He relies on spoken or whispered words for testing the hearing and he does not state whether there is collateral evidence of persistence of the fistula. The tinnitus was certainly lessened.

Recently Lempert of New York has devised a technique to cover the fistula with tympanic membrane and particularly with Shrapnell's membrane.

The operation is one demanding a high degree of skill; but the fistula has been able to be kept open and improvement in hearing therefore made permanent.

Among Lempert's 23 cases were four failures and in these the fistula closed. In those cases in which the fistula remained open improvement always occurred, but it is of interest to notice that some improvement was also found in the other ear too.

He uses the audiometer to test the patients before and after operation and thus shows the change in hearing graphically.

The time that had elapsed between the operation and the published results was really too short to give any indication of final results.

In most cases only three weeks had elapsed, in some only two weeks and in a few three months. It will be interesting to hear the future history of these cases.

In conclusion we must hope that a simple and certain method will be found to keep the fistula open; otology may then hope to live down its reputation for failure to do anything for deafness.

The President said that when the Council of the Section selected this subject for discussion they were anxious that information should be afforded as to the indications for labyrinth operations in such conditions as Ménière's syndrome and otosclerosis, not forgetting the acute conditions. They wanted also to know something about the type of the operation, and finally about its results. He had been approached by several members who suggested that the discussion might be confined to these points.

Mr Watkyn-Thomas said that in a chronic suppuration of the middle ear with evidence of destruction of the labyrinth it was logical to assume that such destruction was due to a spread of infection into the labyrinth. In that case the labyrinth was part of the chronic middle-ear suppuration, and it seemed to him that in operating on the mastoid and on the middle ear they should be careful to follow up that

suppuration to its full extent. He agreed that the operation of labyrinthine drainage by vestibulotomy seemed to supply what was required. The only indication for a translabyrinthine drainage was invasion of the meninges through the labyrinth—that is to say, a meningitis secondary to a suppurative labyrinthitis.

The indications for the destruction in Ménière's syndrome were those given by Mr. Mill—a condition of vertigo incurable and unrelieved by any other treatment, and such as to make the patient's life a burden to him. The indications for labyrinthine intervention in otosclerosis were still very doubtful. The gravest suspicion was aroused in his mind by an operation on one ear which seemed to improve the hearing in the other, the unoperated ear.

With regard to the operations of Sourdille and Holmgren. He had done five of these operations; he would admit they were all in very advanced cases, but in each case he was struck by the extraordinary difficulty in reaching the canal. The difficulty was far greater than was encountered in opening the canal in the ordinary way in a usual case of Ménière's syndrome. There seemed to be very much denser bone and much more of it around the canal. But he had deliberately chosen the more advanced cases, which probably those who had introduced the operation would not deem suitable.

Mr. Walter Howarth said that he had been interested for some time in labyrinthine procedures and had visited on several occasions Holmgren's clinic at Stockholm with a view to finding out his most recent technique. He had now done ten cases following either the Holmgren technique or some modification of it. Mr. Mollison had described the technique of opening the canal, covering it with gold leaf, and filling the cavity with a pad of fat, so that there was no need for him to go into that aspect of the technique; but Holmgren's late results as far as he could discover were not very good, the hearing being only temporarily restored. At the time the canal was opened the patient was able suddenly to hear across a considerable distance, even though he had been practically deaf before, but that improvement, though dramatic at the time, in his own cases had not been maintained. In one case it was maintained for eight weeks, and in another for twelve weeks, only to disappear quite suddenly and for no apparent reason. He had tried several modifications. In one of these, he performed a modified radical mastoid operation and skin-grafted it; six weeks later, he dissected up the epithelium, made the fistula into the canal, and replaced the raised graft. But these cases again were not particularly successful. From his own experience, he did not consider that fenestration of the external canal on these lines had justified the claims made for it. He did not think that any operation of labyrinthine fenestration ought to be embarked upon unless one could give the patients some promise of real improvement in economic hearing, meaning by economic hearing not just a slight improvement in the audiometer readings, but something appreciable for ordinary conversation, and the feeling that they could carry on very much better.

He had not so far carried out Lempert's operation, but his colleague Mr. Bateman recently saw the operation performed in New York and was rather impressed with it. An operation which he had done recently, and which seemed likely to give better results than the Holmgren operation on the external canal, was an operation on the superior canal. It was much more difficult and laborious to carry out. It was suggested by Mr. Sullivan of Toronto, who came to visit his clinic last summer. The idea of the operation was to open the superior canal and allow the dura to fall down on the top of the window and close it up in that way without gold leaf or anything of that kind. From two cases that he had done by this method, it seemed, as far as could be judged at the moment, to be a great advance on the opening of the external canal, and the hearing was better. It was difficult to open the top of the superior canal, but when that was done the dura fell down on the top of it and covered over

the fistula. The dura in contact with the fistula did not seem to promote the growth of new bone, like a foreign body. He thought there was some hope in this operation and he proposed to go on with it.

Mr. T. B. Layton supported Mr. Mollison's contention that operations on the labyrinth were things of the past in so far as the treatment of otitic meningitis was concerned. The bacteriology of otitic meningitis should always be specified. There was the meningitis secondary to a previously infected middle-ear cleft. In his experience the infection was nearly always with the hæmolytic streptococcus; he believed the pneumococcus occurred sometimes, but he had never had a case.

He was beginning to wonder whether in the future they would treat the meningitis first with the sulphanilamides and attack the mastoid later. For the present he maintained that they must first deal with the factory of organisms.

The other group of cases of otitic meningitis were those with pre-existing active disease with organisms from the external auditory meatus such as the staphylococci and the *Bacillus proteus*. There might be a further infection of the hæmolytic streptococcus, or these organisms might themselves be obtaining entrance into the cerebrospinal fluid without further infection. In the first of these, again, operative surgery combined with sulphanilamide was, he thought, the right line of treatment. In the other he thought it might be possible to consider translabyrinthine drainage, but it would take a long time to be quite sure that the case was one of this very small group. In the cases that he had seen the organisms were already growing freely in the cerebrospinal fluid, and the patient was very near death before the mastoid operation was even begun. If he knew it was one of this type of case he would try continuous thecal drainage rather than operate on the labyrinth.

Mr. Sydney Scott said that the historical review of this subject might have included one or two other noteworthy names. Among the first St. Thomas's men to take a practical interest in the surgery of the labyrinth were Sir Cuthbert Wallace, who with Mr. Marriage and Dr. (now Sir) Farquhar Buzzard recorded one of the first cases of division of the 8th nerve. Mr. Mill had mentioned Mr. Cairns, and he would like him to remember another Balliol Scholar of Oxford, namely Charles Ernest West, because after all Mr. West was one of the first to help the foundation of the surgery of the labyrinth; then there was of course Sir William Milligan. As a matter of history he recalled the name of a German surgeon who was the first responsible for introducing surgery to the labyrinth, namely Jansen of Berlin. It was his work which inspired others towards research on the labyrinth, and stimulated the work in Vienna applied to clinical medicine.

Did he understand from Mr. Mollison he never operated on the labyrinth whether there were signs of suppuration or not? He recalled a number of cases where the three semicircular canals were necrosed *en masse*, and sequestrated within a cavity in the petrous bone. In St. Mary's Hospital Museum is a specimen of Mr. Field's of the whole of the necrosed labyrinth. He believed it to be sound surgery in cases of proved labyrinthitis with acute meningitis to open the labyrinth and follow the path of infection just as it was to open all accessible infected cells in the petrous bone. With the development of chemotherapy we may learn in time to modify our indications for mastoid operations.

Mr. Musgrave Woodman thought the operation on the labyrinth for acute sepsis was a trying procedure, though there would be for many years to come cases which justified it. The organisms lay in the greatest profusion at the point where the infection entered the dura. So far as Ménière's syndrome was concerned he had devoted his attention entirely to the Portmann operation. In the average

case—not in every case—the Portmann operation was quite reasonably easy, and he thought the results were extremely good. He had carried it out in six cases, and in five had been almost completely successful. One of these patients was transformed from a complete invalid to a healthy man. One case, on the other hand, was practically a complete failure, but he thought it was a technical failure rather than a failure of the operation. He thought the suggestion just made by Mr. Howarth with regard to lifting up the dura mater was very valuable.

Mr. Victor Lambert said that most speakers had been strangely silent about one obvious advantage of opening the cranium for Ménière's symptom complex, and that was owing to the very real difficulty there was in diagnosing Ménière's symptom complex from certain neurological conditions. He did not know what other people's figures were, but Mr. Geoffrey Jefferson in Manchester had given figures for his cases of cerebello-pontine angle tumour, and he found that 18% of these cases had been originally diagnosed and treated as Ménière's symptom complex. It seemed an obvious advantage, therefore, in view of the real risk of a wrong diagnosis, to open the cranium itself.

Mr. Hall said that he had been very interested in Mr. Howarth's account of the operation for otosclerosis, as he had himself done a number of cases. His experience had been very similar to that recounted by Mr. Howarth, in that there was an immediate, and in some cases, dramatic improvement in hearing. This improvement, however, was not maintained, and in the next few weeks a disappointing diminution of the hearing took place. The increase in hearing which was obtained was at times of such degree that could it, or even the larger part of it, be maintained, patients who were to all intents and purposes deaf before operation would find that after operation they had useful hearing. This, if not quite normal, would at least be so good that those around them would be unaware that they had been deaf.

It therefore seemed that the problem was not whether the operation could improve hearing—that had been proved on many occasions—but how the improvement could be maintained, and that seemed to be a technical problem. Lempert, in America, appeared to have improved the operation, to some extent, by care in certain details. Our thanks, therefore, were due to Lempert for having advanced this treatment another step.

The operation itself had been characterized as being unjustifiable. But as long as the patient was fully aware of the nature of the operation and the chances of improvement, the question of justifiability did not enter into the matter more than in any other attempt to advance the science of surgery.

Mr. Negus said he did not perform these operations, but he had had many opportunities of meeting Professor Holmgren and others and studying the procedure. He thought there was one point which might explain the varying success experienced in some of these operations. If the problem were discussed with a plastic surgeon the opinion would be given that practically all operations so carried out were doomed to failure. If an opening were made in the canal and covered with a layer of mucous membrane or skin with the raw surface facing inwards there was bound to be re-closure of the fistula. He had seen illustrations of specimens in which Holmgren's operation had been performed in which the bone was obviously growing from the edges and re-closing the fistula. The plastic surgeon would say the procedure was doomed to fail unless an epithelial surface could be turned so as to face inwards. The method of doing that—namely, of turning over a flap of mucous membrane so that it faced inwards and then covering it with a skin graft on the surface—would be technically difficult but might be successful in

practice. He had spoken to Holmgren himself about it, who had expressed the view that it was sensible in theory but would be difficult in practice. At the same time it did not seem to be impossible, and if the fistula could be covered by mucous membrane turned inwards the regrowth of bone might be prevented and the operation would then be successful.

Mr. E. A. Peters said that on the point raised by Mr. Negus the case to which Mr. Mill had referred and on which he (Mr. Peters) had operated in 1913, was seen by him only the previous week. The hearing was fairly good, and there was no vertigo, but from time to time there was some oozing around the strand of silkworm gut one end of which was passed into the external canal and the other inserted under the dura. Intermittent oozing occurred through the skin around that opening, and acted to a certain extent as a safety valve. At the time of the operation the exposed area was covered in by a skin graft; the wound healed without sepsis. By this method there was no complete obstruction to drainage by callus formation.

Mr. I. A. Tumarkin asked why it was considered so dangerous to remove the stapes. It seemed to him that it ought to be quite easy to extract it, together with the incus by means of a transmeatal atticotomy. The foramen ovale could then be covered either by a sliding flap, or a skin graft and was far less likely to stenose than any artificial opening into a semicircular canal. After all, bone was only a form of connective tissue and we knew the inexorable tendency to closure associated with any circular opening in connective tissue whether in the urethra, œsophagus, frontal sinus, or anywhere else.

Apart from that, he pointed out that one could only hope to get good results where there was good bone conduction; but surely such people could be definitely helped by the artificial aids to hearing which were now so commonly in use. It seemed to him that a patient who would get benefit from an operation on the semicircular canal would get very much more benefit from a hearing aid.

The President said that with regard to acute labyrinthitis very few speakers had mentioned lumbar puncture. A great deal depended on the condition of the cerebrospinal fluid. He thought a labyrinthine operation should be performed if there were signs of labyrinthitis and the cerebrospinal fluid indicated meningitis.

Mr. W. Mill (in reply) said that he was rather disappointed not to have heard more about the results of the different operations for Ménière's syndrome. It would be interesting to hear what was Mr. Musgrave Woodman's experience in his cases as to the effect on the hearing after the operation he had performed. He himself had always injected alcohol so far because it had worked so well, but he had felt that one should perhaps have just opened the canal and left it with the idea of preserving some hearing; so far he had not had the courage to do so. Certainly in one or two of the reported cases the hearing was improved for a time, but it degenerated later, so that it did seem that the injection of alcohol, although making the cure of vertigo more certain, was not absolutely essential.

As to the difficulty of diagnosis, he himself had all cases seen by a neurologist and he did not operate on them without full investigation. They were under observation and treatment for some months before operation. He would have thought that there was very little difficulty about the diagnosis of Ménière's syndrome in which there were recurrent attacks separated by free intervals of days, weeks, or even months. The symptoms of cerebello-pontine angle, he would have thought, would have been rather different from those met with in conditions of the labyrinth and, on the whole, more continuous.

Mr. Musgrave Woodman, speaking in reply to Mr. Mill's question, said that the patients in these cases were suffering from giddiness, and it was for this that the operation was done. Their hearing was not very bad, and as far as he could judge it was not affected by the operation. He had not considered the question of hearing condition at all.

Two Cases of Vertigo treated by Intratympanic Injection of Alcohol.—W. S. THACKER NEVILLE, F.R.C.S.Ed.

I.—M. J., aged 48. Married.

23.3.38 : Complains of dizziness and tinnitus in the right ear ; onset three years ago. The attacks of dizziness, which are usually accompanied by vomiting, occur suddenly and last several hours ; during the attacks objects rotate from left to right.

Examination with tuning forks shows that the left ear is normal whilst the right ear is deaf to 32, 202 d.v. and a_1, whilst C_4 and C_5 are shortened and a watch which is heard 2 ft. by the left ear is heard 2 in. by the right ear. Bone conduction—as tested by a_1—is absent. Corneal sensation good. Cold caloric applied to the right ear showed nystagmus to the left. Romberg's test showed falling to the right. Galvanic reaction is normal.

The patient was treated with Furstenberg's diet (i.e. a salt-free diet).

As the diet did not cure the patient we decided to destroy the 8th nerve.

10.8.38 : At 8.45 a.m. under evipan, preceded by omnopon, scopolamine and atropine the right labyrinth was injected with 3 minims of alcohol via the tympanic membrane and the foramen ovale, using Mr. Wright's special needle, syringe, and speculum.

At 12.25 p.m. vertigo and nystagmus to good (left) ear and rotation of external objects with nausea and vomiting. The nausea, vomiting and nystagmus continued for four days. On the fifth day the patient was able to eat and slight nystagmus to the good ear was noted.

The patient left hospital on the eighth day.

Tuning fork tests on the fourth day showed that the injected (right) ear was deaf to all forks form 32 d.v. to C_4 ; Weber was referred to the left ear.

II.—W. W., aged 55.

June 1938 : Complained of deafness and tinnitus in the left ear ; then got attacks of vertigo and vomiting. Patient was seen during one attack and rotatory nystagmus to the left ear was observed.

November 1938 : Examination showed—Right ear : good hearing. Left ear : deaf to all tuning forks from 32 d.v. to C_1. Bone conduction (a_1) absent. C_4 and C_5 heard but shortened. Romberg's test shows a sway to the left. Cold caloric test gives a feeble reaction in left ear, and active reaction in right ear.

23.11.38 : Injection of alcohol into left labyrinth via foramen ovale and tympanic membrane. Four hours later nystagmus to the ear and vertigo.

28.11.38 : Discharged with third-degree nystagmus and left ear completely deaf.

Mr. E. H. RICHARDS said that there was one rather important point which had not been mentioned by Mr. Thacker Neville and he had never heard it mentioned by anybody else, namely, the lack of compensation when in the dark which followed this operation. This was present in both the cases shown. He had performed the operation four times, completely curing the vertigo, although, of course, the patients had complete deafness in one ear, but they were not compensated when in the dark ; they were unsteady and staggering. In one case it was now eighteen months since the operation, but little improvement had been made in this respect in spite of exercises designed to bring about compensation, and he was rather worried because of the prognosis when the question was asked by patients or their relatives.

After hearing Mr. Wright's recent paper he attempted in one case to inject through the foramen ovale after a radical operation had been performed six years previously, but he could find no entry for the needle. He then attempted to open the external canal and could find no lumen. Afterwards he opened and injected the posterior canal with complete success.

Three Temporal Bones to Illustrate the Anatomy of Translabyrinthine Drainage of the Meninges and Vestibulotomy.—The PRESIDENT.

The specimens show the vestibule and external semicircular canal which have been opened, also the internal auditory meatus.

I show these specimens merely as an illustration of the anatomy. The cases occurred some years ago. I drained the meninges following the operation by Scott and West. I have had perhaps a dozen cases, but only two successes; these were in fairly early cases of meningeal infection, which recovered and did well. The casts I show are from those used by Neumann for orientation during the operation. He puts these metal casts into the sterilizer, and has them on view while he is operating on the labyrinth.

Discussion.—Mr. ERIC WATSON-WILLIAMS said that he had always been much interested in the question of meningeal drainage through the internal meatus. It was a manœuvre which required a certain amount of courage. He had had only four cases in which he thought nothing else was going to answer, all of them cases of labyrinthitis complicated by severe meningitis, rather late; fortunately three of the patients survived. The first case was most successful, and resulted in very good drainage, although it was eight days from the commencement of the meningitis. He had to curette the internal auditory meatus on the third day following the procedure, because the patient's symptoms recurred: The fluid simply poured from the ear for about a week, and the patient recovered. He thought it was a procedure well worth keeping in mind, although, of course, there was risk of permanent facial paralysis. That was one of the things one had to face; for it was not of much use merely opening the internal meatus, one had to curette out the soft tissues that occupy it.

Mr. WATKYN-THOMAS did not think that facial paralysis was a necessary result of translabyrinthine drainage. He had had three survivors of the operation in whom the facial nerves functioned perfectly well, and another had retained three-fourths of the function. This last case at the end of five years still had a slight paralysis, but in his view this was not a necessary consequence of the operation.

Mr. SYDNEY SCOTT agreed with Mr. Watkyn-Thomas that translabyrinthine drainage did not necessarily interfere with the facial nerve. He had recently seen the first patient on whom Mr. West and he had operated at Saint Bartholomew's thirty years ago. At that time they combined translabyrinthine drainage with continuous lumbar puncture, but he had discontinued the latter.

Were Mr. Thacker Neville's cases treated for a known infection of the internal ear, or because they had Ménière's syndrome?

Mr. THACKER NEVILLE said they were operated upon because they had the syndrome.

The PRESIDENT said that with regard to the occurrence of facial paralysis, he succeeded in avoiding this in one case, but the last case he treated had a definite facial paralysis which still remained. The difficulty of deciding whether to go through the labyrinth or not was a very real one, for one hesitated to destroy the hearing, and hoped the patient would recover without that necessity. Therefore one exposed the whole of the dura and later might do intralabyrinthine drainage.

Section of Psychiatry

President—H. Crichton-Miller, M.D.

[*February* 14, 1939]

Shock Therapy: A Plea for Proportion in Psychiatry

By Ian Skottowe, M.D.

Definition and Range of Observations

Within the field of psychiatry the term "shock therapy" may be taken to mean the induction of a sudden and disturbing physical or mental impression with the object of remedying a pathological condition of mind. Nowadays the term has come to have a special meaning, and in practice it denotes the exhibition of insulin or of analeptic drugs in such doses as to produce coma or epileptiform convulsions, as the case may be, on repeated occasions over a period of time extending up to three months unless the desired result is produced earlier.

The numbers of published observations on shock therapy which have appeared since the initial technical work of Sakel and of von Meduna are so great and so diffuse, and the observations themselves are stated from so many different points of view that it is impossible to codify them—a fact which is stressed by Rees Thomas and Wilson in their recent admirable compilation of a wide and representative selection of results. It is common knowledge that there are extreme variations of observation and opinion, not only as to the efficacy of the treatment but also as to the range of spontaneous remission in schizophrenia, and indeed as to the diagnostic criteria of schizophrenia itself. Given a reasonable degree of standardization of the technique of treatment—and I think that this exists—it is obvious that the explanation of the remarkable variations in recorded results must be sought not in the treatment, but in the clinical material to which the treatment is applied. I propose to approach the subject from this angle; and my aim is to sum up pragmatically the rôle of shock therapy as it appears to the clinician who is faced with the problem of treating the individual case.

Reorientation within the Schizophrenic Field: Clinical Signs

In present-day usage in this country there is a tendency to mean by the term "schizophrenia" a particular disease or pattern of reaction, according to whether one leans towards humoral pathology or dynamic psychology, and if one is forced to apply certain criteria to the delineation of the condition one usually envisages disharmony between mood and thought, a tendency to withdraw from reality, odd hallucinations and delusions, erratic behaviour, apathy and deterioration. I do not consider that these criteria are at all satisfying in the light of experience with shock therapy, and they give a falsely clear-cut picture of something which is intricate in the extreme. Bleuler went no further than to recognize the existence of the schizophrenic pattern within the psyche, and to suggest that the disturbances of thought and association were the primary changes, and that they were of organic origin.

The importance of not being misled by a superstructure of neurotic or of florid hallucinatory or delusional symptoms, nor by incidental variations in the body chemistry, requires re-emphasis, and it has been recently referred to by Mayer-Gross in a concise and simple statement of the clinical diagnosis of this condition. Regard

should be had also to the work of H. S. Sullivan, who records with careful objectivity the richness of the affective life in apparently apathetic or disharmonic schizophrenias. Although these writers have pointed out the difficulties of diagnosis they have not recorded any positive criterion or clinical sign which would be of constructive help. There is such difficulty in relating diagnosis, treatment and result with anything like accuracy that one is forced to the conclusion that there are qualitative differences between the various types of case which we see within the schizophrenic field. From observations which have been made upon an admittedly small but very closely observed series of shock-treated cases at Bucks Mental Hospital—amounting to 17 treated with insulin and 18 treated with triazol or cardiazol—a total of 35, it is believed that a reorientation of the clinical signs seen in cases within the general field of schizophrenia reveals the existence of at least three types of case which call for differently arranged and proportioned forms of therapy. It is proposed to call these groups the dys-symbolic, the dyskinetic and the simple paranoid respectively, and these terms will be defined at a later stage. Shock therapy may at best clear up the florid symptoms in the first group, but it leaves the essential psychopathological change, namely, dys-symbole, untouched. The second, or dyskinetic, group do well with shock therapy; improvement is certain and recovery is probable. The third or simple paranoid group become more accessible with shock therapy, and if it is adjuvated by psychotherapy a good result may be expected, although, *a priori*, a person who is capable of paranoid thinking is probably constitutionally unfitted to face emotional stresses of any but a superficial kind.

The delineation of the clinical signs of these groups of cases was reached as follows :—

For some time we had been inquiring into the thought content in the psychoses. The inquiry was stimulated by the question formulated by Macfie Campbell as to whether the dominant topic in the patient's mind represented some special problem essentially different from that which the same topic would represent in healthy subjects, or whether it was merely a kind of release phenomenon, a positive symptom in the sense in which Hughlings Jackson used the term. We find that there are cases in which each of these propositions is true, and of course they may both hold true in the same subject at the same time ; but something else gradually became apparent, namely that irrespective of the nature of the dominant topic in the patient's mind, and irrespective of whether it is a significantly special problem or a mere release phenomenon, there are cases where the patient is quite unable to formulate his conceptual thoughts and to discriminate between the varying shades of emotional life in language which is intelligible to others. Or it may go further than that, and there may be topics upon which the patient is unable to think in word or language symbols at all, yet the emotional value of these topics is so insistent that they are forced into his mind. As Bleuler has it: "The psyche is confronted by mnemistic impressions from the soma."

In mental health the higher and more personal form of conceptual thinking necessarily involves the use of word symbols. It is the kind of thinking which when translated into language displays the individual differences between one person and another. It calls for a degree of psychic performance which is qualitatively different from that which we use in humdrum relatively impersonal everyday relationships. It has an intimately individual aspect. Bleuler describes the personal quality of this level of thought when he says : "It is something totally different from all else. It is something we see from the inside, whereas we see everything else through our sense organs." Nevertheless, although we see them only from the inside we can convey the existence and nature of our conceptual thoughts to others by the use of language symbols ; and in the act of doing so we are performing at a level of function which is recent in evolution, relatively unstable, relatively poorly

organized and essentially individual, a level which as Angyal suggests, almost certainly has its substrate in the individual areas of Flechsig. It involves something quite different from perceptual thinking, whose less specialized, less individual, less differentiated and practically universal symbols are the common coin of the impersonal situations of everyday life. I submit that it is possible to demonstrate clinically that within the field of schizophrenia there is a group of cases where the essential symptom is the failure of individual conceptual thinking or of the conceptual thinking-language associative mechanism in so far as the patient cannot use the right word symbols to convey what is in his mind or what he feels ; and he is aware subjectively of a change. He is aware that something has gone wrong with his thinking process, but he cannot formulate what he feels about it because the very function which he would use to put his feelings into language is the very one which has gone wrong. It is, if you like a kind of conceptual aphasia, a special type of failure of association, a failure of the higher individual thinking process. To this special psychopathological change I propose to give the name dys-symbole. Dys-symbole bears the same relationship to individual conceptual thinking as dissociation bears to the psyche as a whole. Dissociation is a molar change ; dys-symbole is a molecular change affecting a particular level of psychic function.

The subjective state of mental discomfort which must be experienced by a patient who cannot formulate his personal thoughts or feelings in words is indeed a pitiable one, and it is not surprising that we see states of distressed perplexity, that we hear patients complain that their minds have been taken away, that they cannot think, that their thoughts are interfered with, or that peculiar experiences are being thrust upon them by mysterious agencies. Almost always there is a sense of localized discomfort in the head. I lay great stress on this. Sometimes because of some quite different aspects of the personality such as emotional conflicts and the presence of a tendency to projection, we see this feeling elaborated clinically as hallucinations and delusions of a most bizarre quality centred about the head, the brain or the mind, or such parts of the body as are emotionally linked with individual conceptual thoughts. It is well to remember here the clinical work of Max Levin, who has demonstrated quite convincingly that a possible mechanism of production of hallucinations is the failure of conceptual thinking, so that if a patient thinks of an object at all he can only think of it in perceptual terms, and it therefore appears to him as if it were present to his senses.

I believe that dys-symbole represents a special quality of pathological change occurring at a special level of function, and it is to be sharply distinguished from a diffuse unspecialized change affecting the whole associative mechanism which we see in gross generalized toxic states, and which we recognize clinically by confusion, illusion, disorientation and amnesia.

The key-note to the understanding of its florid manifestations is that any emotional material which exists has to be dealt with not by a healthy but by a damaged integrating machine, and so the characteristically bizarre quality of any hallucinations or delusions which occur is acquired, while the patient does not behave consistently as if his delusions were true, because his beliefs are not what his words appear to convey. This I think is a possible explanation of the emotional disharmony of the schizophrenic.

I would define dys-symbole then as a state of mind which manifests itself by the inability of the patient to formulate his conceptual thoughts upon personal topics or to discriminate the gradations of his emotions in language which is intelligible to others, notwithstanding that he may be in a state of clear consciousness, while he still retains word utilizing ability at the level of perceptual thinking and so is not aphasic in terms of sensorimotor neurology.

Without exception cases showing dys-symbole fail to reach recovery or anything approaching it with either insulin or cardiazol.

Personal Cases. Group 1.—*Dys-symbole*

Case 1 (S. P. S.).—A married man, a carpenter, aged 27, stated that for eight months he had been under the influence of " an electric head ray " or " insane making machine controlled by inmates of the prostitutes' home at Stone ". He declared that this machine was worked by " bishop coffin girls who are thought transferers ". His previous history was clear, save for pneumonia two months before the onset of his mental symptoms. There were no signs of disturbance at the sensorimotor level. The family history was clear. There was no confusion or manifest amnesia. His behaviour, except in so far as he wrote to the Home Secretary and others about his persecutions, was not grossly disordered, and he discussed his unpleasant experiences quite calmly and without apparent distress. He was treated by means of insulin shock. He had altogether 78 comas, and the following is an account of an interview which I had with him at the conclusion of his treatment.

He described his experiences as " the voice conveying ray coming from people in a penitentiary for prostitution who are given the head ray to pass the time in the same way that men are given ropes. Of course you can write it down and think I am insane, and that's all there is to it. I should never have been here, not even for a week ". I asked him what he thought of the treatment he had had, and he said : " Insulin treatment is very dangerous, and it's given to people with split minds, and that's what it did to me, so of course they stopped it. If anyone had told me of these things before last June I'd have said it was delusions." He shows no antagonism towards his persecutors, and he indicates that he does not really believe that they exist, although still at a loss for any other explanation of the peculiar changes which he feels in his mind.

Describing the onset of his illness he said that about an hour after he had gone to sleep one night he woke up and felt something brush across his forehead like something in his brain, and he said to his wife : " There's more in this than meets your eye." He declared that from that day onwards he experienced " auto-suggestions " and " thought memories " day after day. " They said it was third-degree thought murder ; it definitely existed, but I haven't got no proof."

The characteristic features in this case are the onset with head sensation, the difficulty in formulating that sensation in intelligible language, and notwithstanding this, the suggestion that he is aware of his inability to think, as witness his use of the words " thought murder " (obviously meaning " thought destruction "). Then florid symptoms developed, and were characterized by the extremely bizarre and meaningless nature of his formulations on personal topics and descriptions of his feelings. He does not literally mean that he is the subject of third-degree thought murder or that prostitutes in a penitentiary are giving him the head ray, and he says that he does not mean these things, but he cannot describe what he does mean. What is actually happening is that he is experiencing subjectively a series of changes which are in that sphere of the psyche which Bleuler tells us we see from the inside ; and because his conceptual language function is disordered by virtue of the changes which he is trying to describe he cannot formulate them in intelligible terms. Less personal, less differentiated, and more archaic, levels of the psyche are left intact.

Case 2 (M. V. C.).—Omitted.

Case 3 (F. E. W.).—A woman aged 52. An extract from a recent personal examination of this case is presented as illustrating the type of spontaneous formulation seen in dys-symbolic patients. As soon as one started to talk to her she went straight on to the subject of her head sensations, spontaneously. She said : " They " are " drawing little workers up the mind,'' " there " instead of " there " (indicating the front of her head and the top of her head as she spoke). She then said : " This makes your mind rather spire. I broke my own thoughts open."

This case was not treated with insulin, as she is a very advanced case, but it is cited as a good example of the preoccupation with the head and the difficulty of formulation.

Case 4 (W. L.).—A letter received from this patient before I had ever seen him is quoted here as another good example of the spontaneous complaints made by a dys-symbolic patient, this time in the early stages, without any possibility of his formulations having been suggested to him by me.

I think I would like to have treatment for my head in your hospital. . . . I have had headaches, and have had peculiar feelings for several months, and cannot concentrate on anything because I am so worried about myself. . . . Please tell me what day I could see you and come in, as I live a long way away. I feel all right in my body but my head will not think. . . ."

Case 5 (P. P.).—A single woman aged 21 was seen as an out-patient two months after her first symptom had occurred. She had an uneventful personal and family history, and was employed as a tobacconist's assistant. In recent years she had had several attacks of quinsy, and she had mumps six months before the onset of her mental illness, with unusual persistent parotid swelling. She had a mild and quite ordinary love affair which terminated in an undramatic way six weeks before her symptoms began.

The first symptom was depression, which came on two months before I saw her. She began to talk incessantly about the past and to dwell at length on occurrences of her early childhood and infancy which seemed to be without special significance. Then she developed ideas of reference, and finally, as her mother put it " she began to mimic everything you do ".

On examination the right plantar reflex was equivocal; the knee-jerks were greatly exaggerated, and there were a few nystagmoid jerks to the right. The abdominal reflexes were absent. She showed an extreme degree of emotional instability; she was actively hallucinated; in the middle of conversation she would look up at the ceiling and suddenly scream out at the top of her voice, often using foul language. An example of her talk is as follows: " Lord God is with them always. I'm not. My sins were forgiven once. Forget my sins. What do I have to do like this thing. I miss it. What do you call it if spirits are marvellous ? "

She was clearly orientated and showed no memory defect. It was at first suspected that she was a case of disseminated sclerosis with psychosis, but the neurological signs did not show a sufficiently persistent quality to justify this diagnosis, although one still believes that some organic change had taken place. She was admitted to hospital and became more excited. She talked in the following manner: " It is all to with the confabulary. I know it is. I don't know what to do. I wish I could die. I shall take my life."

She failed to respond satisfactorily to prolonged narcosis, and she was discharged from hospital contrary to advice. Three months later she came back again. This time she was largely self-absorbed, and displayed shy giggling. She was still quite clear. The neurological signs showed no departure from normal, except for great exaggeration of the deep reflexes. She displayed great difficulty in thinking. She mumbled, became irrelevant or incoherent on personal topics, and asked to be cured of " evils in the head ". She complained also that people were giving her " opinions " which she described as being a kind of thought control.

She was treated with a full course of insulin, having 69 comas. The florid symptoms subsided, and the patient was able to put up objectively a good performance, but on the very day when she was going to leave hospital, her mother being greatly struck by the improvement in her, I had a talk with her. She talked in quite an ordinary manner on impersonal topics, and when I asked her if she felt anything wrong with her thoughts her face lit up with an expression of recognition. She said: " Yes, that's it. I can't put my thoughts into words." Then she burst out: " Damn you. Damn you all ", and became disturbed and excited.

The case is cited to illustrate the degree to which dys-symbole may be cloaked by florid symptoms, the difficulty of recognizing it in this type of case, and the fact that when all her other symptoms had gone there still remained this characteristic one, which, whenever it was brought to her notice, resulted in an immediate emotional outburst. The fundamental psychopathological change remained.

Group 2.—Dyskinesia

Dyskinesia is taken to mean a disorder of motility of such a nature that the movements are fragmentary or incomplete and appear to be purposeless, although not without a conscious concomitant, when considered in their environmental

setting and in relation to the content of thought. They are thereby distinguished from other disorders of motility such as those associated with the manic-depressive group of cases. Many cases of this group have an important toxic factor in the ætiological scheme, and therefore one is apt to see at any rate for some part of the clinical course a disturbance of the associative mechanism as a whole, characterized clinically by confusion, and quite sharply differentiated from the, as it were, localized disturbance of association which one sees in the dys-symbolic cases.

Case 6 (I. E. C.).—A single woman aged 22, of good family, who worked in the more exclusive type of gown shop. A maternal uncle was neurotic. The patient had been ill for four months when she was received into hospital. Her previous medical history was a completely negative one except for an episode of some mild depression and religious preoccupation in adolescence. She was first noticed to be abnormally quiet and inactive following upon a cold which had not been thought much of at the time. She said then that one of her friends was outside the door of her room all the time. Then quite suddenly came a state of extreme excitement: she tried to leap from a window, she swallowed glass from a broken tumbler, she banged her head violently on the floor. She was admitted to hospital in this state. She made violent unprovoked attacks on members of the staff; she grimaced and made gestures of a grotesque kind; she laughed uproariously or wept without apparent external stimulus. She took no notice of questions which were put to her, and either did not answer or just said "Yes" or "No" in an off-hand fashion. The pitch of her excitement increased. She bit through one of her fingers so that it had to be amputated. When one talked to her about it she said: "Oh, I must do this. I have to suffer for the world. I am married—no—united. Robert Bruce is my name. I am like Hitler—I have to do it." She was grossly confused at the time of these remarks, and it should be noted that although they are disconnected they are not dys-symbolic in the sense that the words that she used would convey an intelligible meaning if placed in their appropriate setting. She made a violent personal attack upon me, and after an initial period of somnifaine narcosis the excitement was still apparent, although not so extreme. She would utter disconnected words and phrases which again were not dys-symbolic, for example, "Independence". "Peggy is only a little girl and wants watching." "Help me." "Glorious." "No." "So-so." Remarks of this kind did actually convey the meaning that she intended them to convey. In this phase she became coprophagic and showed much giggling and grimacing.

She was treated by means of cardiazol, and she had in all seven major seizures. After this I discussed her case with her. She was apparently quite well. She was clear intellectually but had only a little memory for the acute stage of her illness. She remembered biting her fingers and said that she did it because she dreamed that all her joints were falling to pieces. Her description of the onset of her illness was: "Everybody in the street looked odd. I cannot really explain. I felt all dazed to them—sort of sleepyfied, as if they would speak to me and I could not answer them. I remember being terrified of having a bath. I was under the impression that my sister was in the hospital, and I seemed to hear her voice. The nurses seemed to be doubling people I knew. That first treatment I had I thought my relatives were all round as though they were in the next bed. I didn't know where I was until mother came to see me a month ago. I just feel normal again. I don't think much about it. It wasn't like waking from sleep—it was more gradual. When I first got up I used to relapse into daydreams and get mixed up with the other patients. I used to think about the Japan and China war. I used to think one of the patients was the leader of the China war, and I was the leader of the Japan (she laughed at the absurdity of this). I always used to want to get in the fire—I don't know why. It used to fascinate me: the window and the black grate, of course."

In my submission this patient's description of her illness shows a totally different quality of thinking from that of the first case which I described. It is the description which one would expect from a patient who had recovered with insight from a state of delirium, and I would emphasize again that although she is confused, misidentifying those about her and so forth, she does not use, and never did use, unintelligible words or language to convey her thoughts or feelings.

She was discharged from hospital in August 1938. I have seen her personally

on several occasions since then as an out-patient, and from whatever point of view one regards the case she is remaining apparently absolutely well.

Also in this group one finds many cases who have broken down in the puerperium.

Case 7 (K. S.).—Married, 33. Previously a shy, sensitive intelligent woman, who was nevertheless fond of outdoor games. She gave birth to a child a few days before admission, having been quite well until that time. She sustained a perineal laceration, and had been a little alarmed because the birth was three weeks overdue. She awoke from her post-partum sleep alarmed and saying that the baby was dead, although it was in fact all right. The following day she thought that she had not yet given delivery. She became acutely excited, threw things at her nurse, mistook her husband for the doctor, and practically wrecked her room. On the fourth day it was apparent that she had severe puerperal infection. She developed a scarlatiniform rash, and had the usual fever and other signs. She was received into hospital in the condition described and treated with proseptasine and soluseptasine. Ten days later the physical mischief was well under control. She was profoundly depressed and confused. She complained that voices all round her talked at her all day. For three months she continued to be tense, self-absorbed and given to sudden outbursts of weeping. She was utterly lacking in initiative. She would not speak unless spoken to. She became more and more dull and one would have said on ordinary clinical grounds that she was becoming rapidly demented, following the course that one so often sees in the puerperal case and developing into an apparently deteriorated schizophrenic.

Every other reasonable form of treatment having failed, she was given a full course of insulin shock treatment, as she was considered to be too ill physically to stand the less easily controllable cardiazol. At one point during the treatment she cried out during the excited stage preceding coma: "Please help me. I wish I could come to my sober self." She had only 28 comas, and was discharged from hospital thirteen months after she had entered it. She was perfectly well in every way, cheerful, ready to converse freely. She said that she remembered going to the nursing home to have her baby, and everything that happened up to the time when she was given an anaesthetic. After that she said her mind was a blank, although she remembered being put in the ambulance to be brought to the hospital.

Describing the first two or three months of her mental illness she said that she was unable to concentrate on conversation, and felt as if she were miles away. The "voices"—which she now recognized as hallucinatory—were never distinct, but she says they muddled and confused her. I have seen this patient since she left hospital, and she is apparently perfectly well.

The case is cited to show that even where the prognosis is becoming more ominous every day, and even when other forms of treatment have failed, if dys-symbole is not present (and it was not in this case) a favourable issue may reasonably be expected.

Group 3.—*Simple Paranoid Thinking*

The term simple paranoid thinking is applied to cases in this group to distinguish them from the more complex paranoid states, which are really florid manifestations of dys-symbole. In this group there is often—in fact, usually—a major emotional situation associated with guilt or inferiority.

Case 8 (H. H.).—A married man aged 24 had been mentally ill for three weeks when he was received into hospital. On admission he gave an impression of uneasiness. He was able to give leading particulars about himself correctly, but declined to say what his occupation was, and he could not give a clear account of the events leading up to his admission. He complained of noises in his head. After he got over his initial shyness in hospital he was able in a few days to give a perfectly clear and coherent account of himself. He stated that he was worried because he had discussed intimate domestic details with one of his workmates, and he then found that this man had betrayed his confidence and that the others were laughing at him. He believed that the nurses in the hospital knew of this affair, but he could not formulate any way in which they could have gained their knowledge. He would occasionally gaze vacantly about him and handle small objects in an aimless manner. He gave a complete chronological account of his life with a

great mass of detail, and he described his feelings that his workmates were talking about him and laughing at him. He said : " Quite suddenly everything went black " and, " I resisted everything they tried to do for me ". He felt that everything he read referred to him, and that he had a mission, this being " a duty to do, under cleanliness ". As he was about to leave the room after this interview my colleague said to him : " Is there anything else you want to say ? " and he replied : " I have been wondering if you might be my father." (It should be explained that he was brought up in an orphanage, and virtually never knew his parents.) We thought at first that the oddities of this patient were due to dys-symbole, but closer examination showed that this was not so.

He was treated by means of insulin, and objectively he appeared to respond very well. By the time he had had 11 comas it was impossible to find any psychiatric symptoms at all. He had 15 comas, and he then seemed to have at any rate superficial insight into his condition. Against advice, but as it seemed expedient from the social and economic point of view, and in view of his freedom from symptoms, he was then discharged. He was back in hospital again within a month because he had been wandering about the streets in the small hours of the morning. He created a disturbance in the premises of a celebrated chain store company, and although he had started off well, he had been quite unable to do his work properly, and could not handle with precision tools with which he had been previously familar. He was then treated with more insulin, and he had 25 further comas, making 40 in all. After this in the course of conversation he spoke more freely of the incidents leading up to the onset of his illness. He stated that he had practised coitus *a tergo* but not coitus *in ano* with his wife, and that he had told one of his workmates about this. He had described all this on a previous occasion, but he went over it again, and he then described an incident which he had not mentioned before. He and scores of his fellows were coming out of the works where he was employed, on bicycles and on foot, and one of his workmates shouted out across the road at him : " There goes doggy," and many of them laughed. It was then that everything had gone black. One had only to see the objective display of emotion with which the patient recounted this incident to realize what very great emotional value it had for him, and what terrible opprobrium attached in his mind to this jocular and coarse accusation, so much so that he had been quite unable to bring himself to speak of it previously.

As one had rather tended to dismiss his description of coitus *a tergo* as something of relatively little importance, one had not grasped to the full what this meant to the patient, but in the light of the explanation which he now gave, his subsequent difficulty at the works became intelligible, and with the application of simple psychotherapy and a readjustment of the environment, the patient became, and has remained, perfectly well.

This case is a good illustration of insulin paving the way to other forms of therapy, and although it is difficult to produce evidence in support of it, it is my own conviction that but for the insulin treatment, the patient would never have been in a condition where he could bring himself to speak of this incident and to display the remarkable degree of emotion in connexion with it which he did display.

It is of the utmost importance to recognize that although there are three clinical groups, if dys-symbole is present it, as it were, takes precedence over all else from a prognostic point of view. A dyskinetic case which was also dys-symbolic would not be likely to give a favourable response, and neither would a dys-symbolic paranoid.

Theory of Action of Shock Therapy

A review has already been given by Angyal and more recently by Rees Thomas and Wilson, so I propose to state here briefly only those which seem to me to have been borne out by experimental work, and which produce a sense of satisfaction when applied to the observed clinical facts.

Angyal suggests that insulin acts first and most intensively upon the cortical components of the schizophrenic process, which first attacks Fleschig's terminal region—which he says is the most differentiated and the most sensitive. Since the easily injured nerve cells which lie in this region soon give off their sugar reserves in progressive hypoglycæmia, they reach a state of excessive sugar hunger. This metabolic impulse when repeated makes the healing of diseased nerve cells possible.

The process is, according to Angyal, that there is some sort of biochemical stagnation, and provided that this has not gone on for too long so that the changes have become irreversible, the cell may be restored to a state of normal chemical functioning by depriving it of sugar to such an extent and with such suddenness that its whole sugar-oxygen metabolism is stimulated. He suggests that cardiazol brings about its beneficial effect in the same way by producing a vasoconstriction followed by vasodilatation occurring suddenly, and that this is the circulatory impulse analogous to and probably accompanied by the metabolic impulse. We know from the researches of Quastel, Gellhorn, and others that sugar and oxygen are two chief necessities in nerve-cell biochemistry, and are complementary to each other; and we are familiar with the work of Golla and others of the Maudsley group of workers who have demonstrated the disturbed acid-base balance and the disturbances of oxygen metabolism in schizophrenia. Bringing these works into line with one another, Angyal's theory appeals to me as being close to the mark, and he explains why these two, insulin and cardiazol, so entirely different in their pharmacological actions, and which externally seem to have such different modes of attack, have, in fact, a common mode of action so far as the ultimate disease component is concerned. The essential therapeutic action is not obtained by the hypoglycæmia as such, but by the subsequent sugar mobilization in which the cellular elements of the nervous system take part, and this is borne out by the clinical experimental work of Day and Niver on a series of 78 cases. They found that hypoglycæmic shock was not due to hypolgycæmia. Many patients will maintain a blood-sugar level between 15 and 20 mgm. per 100 c.c. for several hours and show only mild symptoms such as sweating, hunger and pallor, and they will then go into shock while the blood-sugar level is actually rising. They found further that the normal ratio of blood-sugar to cerebrospinal fluid sugar, which is about 10:8 or 10:6, is reversed during treatment, and by plotting the blood-sugar against the cerebrospinal fluid sugar at half-hour intervals they have shown that the state of coma or shock occurs only when the cerebrospinal fluid sugar falls to a point between 30 and 15 mgm.%. This seems to bear out the view that it is when the nervous tissues are called upon to give up their sugar and have no more to give up, that shock occurs, and the treatment must be pushed to this level in order to stimulate the necesssary sugar hunger in the nervous system which will eventually restore the metabolic balance. The authors point out, consistently with Magenau's view, that the external reactions observed during insulin shock, are quite intelligible in terms of vagotonic sympatheticotonic balance.

SUMMARY

It appears that there is a qualitative difference between various cases that are seen clinically under the general label "schizophrenia". These groups are recognizable by clinical signs and three such groups are delineated by this means, namely, the dys-symbolic group, characterized by failure of personal conceptual thinking, difficulty of language-formulation, and the consequent bizarre quality which appears in any emotional material which has to be dealt with. Almost always there are uncomfortable head sensations. Secondly, the dyskinetic group characterized by difficulty or failure of motility, its hallmark and that which distinguishes it from disorders of motility in other psychoses being the apparently purposeless nature of the motility when considered in relation to environment, and to the content of thought. Finally, the group characterized by simple paranoid thinking, without difficulty of formulation, and in a clear intellectual setting.

Dys-symbolic cases fail to reach recovery with shock therapy, and except for the purpose of improving the general health or abating florid symptoms to some extent, it is a waste of time, money and skill to apply it to them. I know that we hear a good deal about social remission—a specious and misleading term—and while one may return to his former occupational level a labourer who is still grossly disordered as regards his thinking process, it is absurd to pretend that, say, a banker, a physician

or a scholar could be restored to his corresponding level of social and occupational function.

Dyskinetic cases do well with shock therapy, and inasmuch as the major ætiological factor is often a toxic one, little else is required. Cases in poor physical health—always without prejudice to the major contra-indications—are best treated by insulin, because it is more easily controlled. In cases where the physical state is a robust one, cardiazol or triazol may be tried first, especially if ease of application and economy are major considerations. If cardiazol fails to produce the desired change fairly soon, it is little use trying insulin, and vice versa. The proper course then is to summate the two : but in such cases, a careful re-examination of the patient may reveal dys-symbole, in which case it is useless to go on with shock treatment. The simple, orthosymbolic paranoid usually needs psychotherapeutic help, and for him shock therapy appears to pave the way. As regards its mode of action, the most convincing evidence so far supports the view that shock therapy acts by stimulating the sugar-oxygen metabolism of the nervous system whether it is applied in the form of insulin or analeptics, and the external manifestations are due to incidental changes in the endocrine-autonomic balance.

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Dr. J. Brander : There is a real risk of over-estimating the value of shock therapy because of its novelty. All treatments of mental disorders depend for their results to a great extent on the personality of the physician and nurses and the circumstances in which the treatment is effected. On this account " standardization of the technique of treatment " is scarcely practicable. The symptomatic grouping of types introduced by Dr. Skottowe is of interest but would require systematic clinical application by others for proper evaluation. It is doubtful if we are justified in relating mental disorders to areas or levels of the brain or in attempting precise classification of schizophrenic types with regard to which there is no agreement. Many neuroses and psychoses are found in association with schizophrenia during the life-time of individuals. Innumerable factors may serve to recall schizophrenics from the detachment into which they have passed. They do not respond as readily to external impressions as to perceptions and imagery originating within themselves. For long it has been recongized that emotional and physical stimuli served to bring many patients once more into relation with their environment. Shock therapy as now practised is associated with more intense and hopeful management of the patients than in recent years. The innumerable forms of psychological and physical shock once employed presumably operated mainly by psychological means. We must take pains to discriminate between the improvement which may be ascribed to physiological changes in the patient, the data relating to which are variable and inconsistent, and that which may be referred to the increased interest and enthusiasm shown in the general management of schizophrenics since the introduction of various forms of shock therapy.